

A Study in Association Reaction and Reaction Results

With an Attempted Application of Results
in Determining the Presence of Guilty
Knowledge

A thesis submitted in partial fulfillment of the require-
ments for the degree of Doctor of Philosophy
in the University of Michigan

BY
HARRY W. CRANE

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The work herein presented was conducted under the direction of Professor Walter B. Pillsbury. To him, and to Professor John F. Shepard whose suggestions were of great assistance both during the process of the experiments and in the final preparation of this paper, I wish to express my gratitude. I am also indebted to the students who so willingly acted as subjects.

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A STUDY IN ASSOCIATION REACTION AND REACTION TIME

WITH AN ATTEMPTED APPLICATION OF RESULTS IN DETERMINING
THE PRESENCE OF GUILTY KNOWLEDGE

I. INTRODUCTION

THE PROBLEM SUGGESTED

In the spring of 1909 the writer became interested in the possibility of making an application of the association reaction as a test for guilty knowledge of crime. With the purpose of satisfying myself that I was right in believing in the success of such an application, I undertook to test four subjects selected by another person. One of these subjects had been put through an act, the details of which I had myself arranged. The problem was to determine which one of the four subjects tested had gone through this experience. The test proved successful in that it gave data which made it possible to solve this problem. However, the results were not as convincing and reassuring as the optimistic writings of Münsterberg and others had led me to anticipate. For this reason another similar test was made, with utter failure as the result.

Even after this second test, my faith in the efficiency of the method was still firm, although I had begun to doubt the value of the criteria used to judge the results of the test. There were several facts that stood out rather prominently in these preliminary experiments part of which seemed to be out of harmony with the statements that had been made concerning the association reaction times. There were many instances in which there were as long, or even longer, reaction times among the non-guilty, as among the guilty subjects. There were also instances even among the guilty subjects in which the reaction times to the non-guilty words were as long as, or even longer than, the

reaction times to the guilty words. As no introspections were taken in these preliminary experiments we could not tell the cause of these lengthened reactions. Yet we could not help but wonder whether they were all due either to the direct inhibition by the subject of the first association that came to him, and the substitution of some other, or to the retarding effect of the arousal of an emotional complex, as both Jung and Münsterberg would lead us to believe.

It was also noticed that, in general, with nouns the reaction times seemed to be longer than with adjectives. This naturally raised the question of whether or not the verbal form of the stimulus had any effect upon the length of the reaction time. That there appeared to be more noun than any other form of response to adjective stimuli raised the connected question of whether this was purely accidental in the few cases we had before us, or whether the verbal form of the responses really does have some relation to the verbal form of the stimuli. Naturally from these two questions arose a third—does the verbal form of the reaction have any influence upon the length of the reaction time?

One of the guilty associations in the first preliminary test was stamp box. The words stamp and box were chosen as two of the test words and, accidentally, were placed in the test list in such an order that the one followed the other. In most of the cases the second word of this pair brought as a reaction the first word of the pair—that is the word that had just preceded it in the test list. Then came the question, was this accidental, or would it hold for all words thus habitually belonging together and paired as successive stimuli? Also, what would be the effect upon the reaction time in cases when such a result was obtained, and in cases in which it was not obtained? This question of the influence of one stimulus word upon the reaction to the succeeding word suggested that it would be interesting to test other possible forms of influence. What would be the possibility of influence where the two words paired were commonly connected by a conjunction, as Pork and Beans, and the first stimulus given was the second of the sub-

stantives, while the second stimulus was the first of the two substantives together with the conjunction? Again, what would be the effect upon the reaction to a given stimulus in cases in which that stimulus was preceded by a statement of a given situation of which the subject was instructed to be thinking at the time the stimulus word was given? In both of these cases there would arise the question of the effect of any such possible influence, or attempted influence, upon the length of the reaction time.

The final suggestion of a possible form of influence that grew out of these questions was of a verbal character. Suppose that you have a certain number of stimuli of one definite verbal form, nouns or verbs, followed by a certain number of indefinite or ambiguous forms—forms like *boil*—that can be interpreted as either verbs or nouns, and at the same time have entirely distinct meanings depending upon which interpretation is made. Then, in such cases, will the preceding definite forms influence the interpretation of the indefinite forms? If answers to these questions could be found, it would seem to make possible a much more definite and fruitful application of the association reaction as a test for criminal knowledge.

LITERATURE

While there has been a vast amount of work done upon various phases of the association problems, yet the literature dealing with those particular aspects of the question in which we are interested is rather limited. There are two main lines along which investigation and experimentation, looking toward the practical application of the association test as a means of mental diagnosis have been developed. We will briefly review the history of each of these.

In surveying the work that has already been done in the experimental study of association and the application of the association test, it is not our purpose to go into the details of what each and every worker has individually contributed, but rather to state as briefly as possible the beginnings of the work, with the resulting main lines of development which it

has taken; together with a placing of the more important contributors in their proper historical sequence. Where details of the results of particular investigators have a definite bearing on the results of our experiments, these details will be given in foot-notes in connection with the main body of the thesis.

Francis Galton (3) in 1879, was the first man to investigate association experimentally. His experiments were entirely upon himself, and the main part of them consisted in the use of 75 stimulus words, in response to which he wrote down the words that they suggested to him. He used this same list of words at different times in four different environments. A record of the time taken in his process of association was recorded with a chronograph controlled by his finger. From these results he showed in a general way the range of association, very roughly the time required for the association process, quite clearly the greater fixity of the earlier associations. He noticed that abstract terms gave more difficulty in forming associations than did concrete terms. He also made an attempt to classify associations according to types. His three groups were: Sense imagery type, "histrionic representations," and "the imagined sound of words, as in verbal quotations." This last was frequently, "a mere parrot-like memory which acted instantaneously and in a meaningless way, just as a machine might act."

The grounds on which he fails to give the detailed results of his experiments—that "They lay bare the foundations of a man's thoughts with curious distinctness, and exhibit his mental anatomy with more vividness and truth than he would probably care to publish to the world"—foreshadowed the coming diagnostic application of the association test. He states that the object of his experiments is "to show that a large class of mental phenomena, that have hitherto been too vague to lay hold of, admit of being caught by the firm grip of genuine statistical enquiry."

This object he evidently accomplished, for the importance of the problem was almost immediately recognized by Wundt (10.) who took it up in a more careful and thorough way than

had Galton. Cattell (2) in 1887, and Cattell and Bryant (1) in 1889, published articles dealing with the subject experimentally, and from this time on there have been articles by numerous authors taking up various phases of the association problem. All of this work added greatly to the knowledge of special aspects of the problem, but it was not until 1905 that we had the appearance of the first of a series of articles detailing the results of work done by C. G. Jung (4) in establishing types of association, and later in the application of these results as a basis upon which a diagnostical study of certain abnormal forms, principally hysteria and dementia praecox, could be made.

We have stated in a general way the historical beginnings of the experimental study of association. If Jung was indebted to this source for suggestions as to the means which he would develop into a diagnostic mechanism, he was indebted to another source for the suggestion that there was any use for such a mechanism. It was from those who were interested in psycho-analysis that he gained this suggestion.

It was Dr. J. Breuer, of Vienna, who in 1881 made the first definite and thorough use of the psycho-analytic method, and this upon an hysterical patient who had failed to respond to other treatment. About ten years later Dr. Breuer, together with Dr. Sigmund Freud, again took up investigations along these same lines. Freud later continued this work by himself. Jung, as a pupil of Freud, naturally became interested in this line of activity, and it was through this interest and the desire to substitute a simpler mechanism of psycho-analysis for the somewhat cumbersome one employed by Freud that he developed the association test.

Other men have used this method in trying to determine the associational complexes responsible for certain neuroses, and also have applied it in the investigation of crime (see Bibliography), but even here Jung claims priority on the grounds that he developed the method and first made suggestions towards its use in criminal investigations. Jung has also used the method in obtaining evidence of guilt in cases of theft and other minor offenses that have come up in connection

with his own regular practice. Aside from the success which attended this work in these cases and which seems to show that the association method can, and has been, successfully used under certain rather restricted conditions, we have the rather recent case recorded by Edwin W. Katzen-Ellenbogen, M.D. ("The Detection of a case of Simulation of Insanity by Means of the Association Tests." *Jour. Abn. Psy.* Vol. 6, No. 1.) A man charged with committing highway robbery was committed on the certificate of psychiatrists to the Danvers hospital as an epileptic. He had shown amnesia and was described as being in such a drunken condition at the time of the assault that he would be unaccountable for the act. By means of the association tests, results were obtained that convinced the doctor that the man was simulating. The subject later made a complete confession. But despite the success of the results in this case, the author very frankly states the limitations of the use of the method. In the closing paragraphs of his article he says:

"This example proves that psychology, in its present adolescent state, can be of assistance in problems of practical life, although it would be entirely wrong to contend that by the association test the truth of a person's statement could be positively determined. Indeed, if the association test were to be used for this purpose, I should prefer to refrain from its use altogether.

"Some writers on this subject seem to entertain this dangerous delusion, which would lead to more miscarriage of justice and errors than one could possibly imagine. Our psychic apparatus is too complicated to admit of its subjugation to such a mechanical law.

"I believe, however, that by skilful application to certain cases, the association test may prove a very valuable addition to many tests in criminal investigation work, as has been lately shown by the Bertillon methods, etc., and be of great assistance in many instances for clearing away doubts as to the truthfulness of witnesses.

"In the case under review, I worked with a man wholly

unprepared and incapable of understanding the purpose of the investigation, ignoring the facts that a hesitation, a change of word in the reproduction, were the very instances which would most convincingly tell against him. Considering even the circumstances of his knowing these facts, of his even being a psychologist, quite skilful in psychological technique, he would be equally unable to control the form of his answers and the time of associations, even to a fraction of a second. The attempt to control his answers or prepare them beforehand would incriminate him more than anything else. In this way a refusal to cooperate might be equally harmful as a result.

"The case I have reported is in many ways a model case and one would probably not find such an easy task as this one proved to be. Nevertheless, it can be said that the association test will always be of some help in advancing a criminal investigation."

I have quoted this so fully, because it seems to me to present very well the possibilities and limitations of the association test in the field of criminal investigation.

The main criteria upon which practically all workers agree in basing their determination of the existence of a submerged complex in insanity, or, and this is of more interest to us, the guilty knowledge of persons accused of crime, are lengthened reaction times, and the indications received from the reaction words themselves.

The subject to be tested is given words, as in the ordinary association test, to which he is instructed to reply with the first word of which he thinks. In this test list of words are inserted, at irregular intervals, a number of words connected with the details of the crime for guilty knowledge of which the subject is being tested. If the reaction times to these crime-associated words are longer than the average reaction times of all the other words in the list, then that fact is taken as an indication of guilty knowledge on the part of the subject tested. The retardation of reaction time with words having guilty association has been quite generally explained as the result of one of two causes. It is either due to the inhibition of the reaction as the result of the

arousal of an emotional complex in the mind of the subject, or to the conscious inhibition by the subject, because of his recognition of the incriminating nature of the first word that came to his mind. Arousal of guilty association trains may have a retarding effect upon the reaction times to words immediately following the stimulus which called up this train. The emotional excitement aroused may be sufficiently strong to carry over and cause an inhibition; in fact the emotional complex may first be aroused after the reaction to the guilty stimulus has already taken place.

As to the reaction words themselves. It is a familiar fact that when the association between words or ideas is very strong, this association finds expression almost spontaneously, and thus the subject often betrays himself before he realizes that he has even reacted. If after he has thus reacted he does realize that he has given damaging evidence, this realization generally causes a confusion and a consequent retardation in the reaction, or reactions, immediately following. Again, if several words of different nature, yet all having guilty associations with the same particular detail of the crime, are introduced at different times in the test, the subject, if he has successfully got by the first of these words will not be on the lookout for other words having the same association tendency, and is therefore the more apt to unconsciously betray himself when these words appear.

If the test series is repeated after a short interval with the instruction to respond to each stimulus with the same word as used in the first test, it has been found that more changes in response are made in the reactions to the guilty stimuli than in the reactions to the non-guilty stimuli. This fact is explained as due either to the forgetting, as the result of emotional excitement attending the previous reaction, or to an attempt to remove incriminating evidence given in the first reaction.

This represents the development, and the present status of the applied association test so far as it has been accomplished by Jung and his followers. It is primarily a test based upon a comparison of the reaction times to guilty and non-guilty stimuli, together with a study of the reaction words to stimuli of the

former type. There has, however, been a more recent development along a slightly different line.

This later line of activity in the field of association experiments has looked toward the development of "Frequency Tables" in association. The first suggestion for such tables came from Gertrud Saling (7) in 1908. Incidentally to experiments confirming earlier work of Thumb and Marbe on some related problems, Saling unsuccessfully attempted to justify the hypothesis upon which those who had been attempting to apply verbal association to the field of criminal investigation had been working. She then suggested compiling tables showing the frequency with which the same response was given to the same stimulus, by different subjects. Her own compilations of this kind, being made with a class of only 34 girls from 7 to 8 years of age, were too slight to be of practical value, but served at least as a suggestion for future work. This suggestion resulted in the publication two years later of the work of Ferdinand Reinhold (6), detailing the reaction to 46 stimulus words of 30 school children from each of 10 successive grades. These results were used, among other things, to show the most common responses to each stimulus word.

It was in 1910 that the most elaborate work on frequency of association was published. This work of Grace Kent and A. J. Rosanoff (5) gave the reactions of 1,000 subjects to 100 stimulus words. These reactions were tabulated to show the variation and frequency of response of the different subjects to the same stimuli. Thus we have established, for the words used, a really comprehensive frequency table. These authors also made application of their results to insane subjects, and found more or less marked variation from the normal responses, and somewhat characteristic variations for the different forms of neuroses.

While this work of frequency in association is of immense value in its application to insanity, its value in the criminal field remains to be demonstrated. These last two workers, who have done most in establishing and using frequency tables, have entirely neglected this aspect of the practical use of their

material, while Saling and Reinhold did but little more than suggest such an application.

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MATERIAL—APPARATUS—METHOD

With the purpose of first trying to find answers to the questions resulting from our preliminary experiments, and then making use of the material so obtained in a further attempt to test the real dependability of the association method as a test for guilty knowledge of crime, a suitable list of words was prepared. This list contained fifty each of definite noun, verb, and modifier stimuli. Ten of the noun stimuli were abstract terms. This part of the series was designed to test the possible influence of the verbal form of a stimulus upon the length of the association reaction time. The following word groups were chosen to test the influence of one stimulus word, or words, upon the reaction to the succeeding stimulus. (1) Ten pairs of the nature, *Music, Box*. Five of each of these pairs appeared

in each test in this order, *Music, Box*. This we called the direct form of influence. The other five pairs appeared in the reverse order, *Box, Music*, which we called the indirect form of influence. In part of the tests made the order of all these ten pairs was reversed, that in the case of individual pairs a comparison of the relative influence in the two orders might be made. (2) Ten pairs of the character of *Beans, Pork and*, which we called the *and* form of influence. (3) Ten ambiguous forms, five of which were preceded in each case by ten simple definite noun forms, and the other five by ten simple definite verb forms. In a part of the tests there was an interchange of the two groups of indefinite forms, in order that each group might come under the possible influence of both definite noun and verb preceding forms. (4) Four words, and in the last twelve tests five words, each preceded by an oral statement from the experimenter of a situation that the subject was told to keep in mind. The following is the list of words in the order in which they were given. In seven of the tests made the stimuli 1 to 10 inclusive were interchanged in position with the stimuli 20 to 29 inclusive. In the same number of cases the two stimuli 16 and 17, 35 and 36, 45 and 46, 66 and 67, 78 and 79, 104 and 105, 110 and 111, 152 and 153, 182 and 183, 192 and 193 were interchanged in position.

1. Ear	17. Counten	32. Sign
2. Goat		33. Fit
3. Needle	18. Beans	34. Stand
4. Lamp	19. Pork and	
5. Heart		35. Sweeper
6. Teeth	20. Eat	36. Carpet
7. Spider	21. Read	
8. Star	22. Use	37. Lake
9. Cow	23. Rob	38. Sympathy
10. Wool	24. Run	
	25. Lend	39. Milk
11. Watch	26. Take	40. Bread and
12. Jar	27. Warn	
13. Match	28. Find	41. Green
14. Pound	29. Suck	42. Sick
15. Train		43. Tiresome
	30. Pick	44. Straw
16. Lunch	31. Boil	

- | | | |
|------------------|----------------|--------------------|
| 45. Chimney | 84. Eggs | 124. Tearful |
| 46. Sweep | 85. Ham and | 125. Advertise |
| | | 126. Funny |
| 47. Grow | 86. Quick | 127. Cup |
| 48. Gloomy | 87. Hat | 128. Windy |
| 49. Stumble | 88. Fail | 129. Listen |
| 50. Provide | 89. Despise | 130. Ripe |
| 51. Stupid | 90. Excitement | 131. Lion |
| | 91. Sky | 132. Muddy |
| 52. Buggy | 92. Mattress | 133. Lawyer |
| 53. Horse and | 93. Owe | 134. Blue |
| | 94. Dirty | 135. Brick |
| | | 136. Nice |
| 54. Activity | 95. Bacon | 137. Expect |
| 55. Negro | 96. Liver and | 138. Learn |
| 56. Bright | | 139. Greasy |
| 57. Accept | 97. Conclude | 140. Door |
| 58. Damp | 98. Recite | 141. Weary |
| 59. Reap | 99. Preacher | |
| 60. Marvelous | 100. Sandy | 142. Rolls |
| 61. Stork | 101. Prison | 143. Coffee and |
| 62. Cigar | 102. Pleasing | |
| 63. Imitate | 103. Snake | |
| 64. Boisterous | | 144. Alert |
| 65. Admire | 104. Box | 145. Possess |
| | 105. Music | 146. Onion |
| | | 147. Go |
| 66. Store | 106. Consider | 148. Purple |
| 67. Drug | 107. Slippery | 149. Husband |
| 68. Ragged | 108. Chocolate | 150. Receive |
| 69. Threaten | 109. Forgive | 151. Dark |
| 70. Month | | |
| | 110. Suit | 152. Cushion |
| 71. Cheese | 111. Case | 153. Pin |
| 72. Crackers and | | |
| | 112. Fresh | 154. Arise |
| 73. Abuse | 113. Handsome | 155. Sew |
| 74. Protect | 114. Get | 156. Angel |
| 75. Baby | 115. Peculiar | 157. Difficult |
| 76. Costly | 116. Hell | 158. Poor |
| 77. Red | 117. Yellow | 159. Hesitation |
| | 118. Dusty | 160. Careful |
| 78. Salt | 119. Shady | 161. Kill |
| 79. Pork | | |
| | 120. Dance | 162. Cake |
| 80. Gather | 121. Sing and | 163. Ice-cream and |
| 81. Key | | |
| 82. Considerate | 122. Sincere | 164. Harmful |
| 83. Follow | 123. Farmer | 165. Approval |

166. Borrow	179. Believe	192. Syrup
167. Mean	180. Ability	193. Maple
168. Wisdom	181. Rich	
169. Feel		194. Knowledge
170. Policeman	182. Coal	195. Friendly
171. Bashful	183. Bin	196. Come
172. God		197. Purpose
173. Bake	184. Tell	198. Allow
174. Proud	185. Decision	199. Feeble
175. Ladder	186. Send	200. Physician
	187. Simple	*201. Nationality
176. Butter	188. Skilful	*202. Tom
177. Biscuit and	189. Apple	*203. Organ
	190. Conquer	*204. Brush
178. Unkind	191. Dry	*205. Shri11

*The subject was instructed in the case of each of these words to be thinking of a given situation at the time that the stimulus was given. 201. A burning clothing store. 202. Slavery times down South, before the Civil War. 203. An Italian quarter in a large city. 204. The great American desert. 205. Noon hour in the manufacturing district of a large city.

The stimuli, typewritten in upper case, were shown in an Ach card exposure apparatus placed in an electric circuit with a lip key and a Hipp chronoscope. The connections were so made that the exposure of the stimulus word completed the circuit starting the chronoscope; the reply of the subject breaking the circuit.

Each subject was instructed that upon seeing the stimulus he must react with the first word that came to him. It was emphasized that only one word must be given in response. The subject was also asked at the beginning of the test to give as detailed an introspection as possible after each reaction, as to the processes involved in following the instructions. Furthermore, throughout the experiment he was frequently asked for special introspections. Whenever there were markedly delayed reaction times he was asked to explain the cause. However, it can not be too strongly emphasized that no leading questions were asked. It was, "What was the trouble," or "How do you explain that," and not "Was this due to so and so."

The subjects used were all University of Michigan students,

taking the second semester course in general experimental psychology. A number of these were mature, careful students. The following gives the essential facts as to sex, age, and rank in the University (given in parentheses) and any other pertinent information. *G* means graduate student.

No. 1—M., 22, (4); No. 2—M., 20?, (2); No. 3—M., 22, (3); No. 4—M., 22, (4); No. 6¹—M., 22, (4); No. 7—M., 20, (3); No. 8—M., 22, (4); No. 9—F., 20, (2); No. 10—M., 28, (G.), A Chinese student who had been in this country two years, but had studied the English language in the Mission schools of China for about eight years; No. 11—M., 23, (3); No. 12—M., 21, (3); No. 13—M., 35, (4), An Assistant in the Department of Oratory; No. 14—M., 28, (4), Negro; No. 15—F., 25, (3); No. 16—M., 23?, (3); No. 17—F., 22, (3); No. 19—M., 44, (G.), Missionary from India; No. 20—M., 36, (G.), Instructor in Mathematics at the State Normal College; No. 21—M., 22, (2); No. 22—F., 21, (3); No. 23—M., 24, (G.); No. 24—M., 30, (4); No. 25—M., 25?, (4), Negro; No. 26—M., 28, (4), Chinese, in this country eleven years; No. 27—M., 20, (2); No. 28—M., 30, (4), Nurse, graduated from McLean Hospital; No. 29—F., 25, (2); No. 30—M., 20, (2); No. 31—M., 21 (4); No. 32—F., 21, (3).

¹No. 5 and No. 18 omitted because the experiments were not completed with these subjects.

II. DISCUSSION OF EXPERIMENTAL RESULTS

VERBAL FORM OF STIMULUS

In the tables A 1-32 will be found a summarized tabulation for each of the thirty subjects used, of all the results that have a bearing on the question of verbal forms. These tables show for each individual (1) The general average reaction time for all the successful responses to all the concrete nouns, the verbs, and the modifiers, (2) The average reaction time for the responses to each of three verbal forms, concrete nouns, verbs, and modifiers, (3) The average reaction time for the responses to the abstract nouns, (4) for the responses to nouns used by the subjects as adjectives, and (5) The distribution of the re-

sponses, to noun, verb, and modifier stimuli, according to the verbal form of these responses, together with the average reaction time for each of these classes of responses for each form of stimuli.

We will first take up the question of whether or not the verbal form of the stimulus has any effect upon the length of the reaction time.¹ By referring to tables A 1-32 the reaction time of any subject for each of the three verbal forms used, nouns, verbs, and modifiers, can be determined. Table A₁ briefly summarizes the facts for the entire thirty cases. These facts show that *there is* a marked difference in the reaction time to these three different forms of stimuli. In exactly two-thirds of the cases the modifier form of stimuli gave the shortest average reaction time of the three forms used, while in almost as large a proportion ($63\frac{1}{3}\%$) of cases the verb gave the longest average reaction time. This left the noun stimulus in an intermediate position as regards the length of the average reaction time. In about one-third of the cases its average reaction time was shorter than the average reaction time of either the verb or the modifier stimuli; in about one-third of the cases it was longer.

If we take the general average reactions of all of the thirty subjects to all of the different stimuli of each of the three verbal forms tested (see the general average at head of table C) we find that from this standpoint also the position of the noun is intermediate. In these actual total averages for each verbal form the verbs have the highest, the nouns the next highest, while modifiers have the lowest reaction time.

In the case of every subject, of the words given as noun stimuli at least one, and ranging from this up to nineteen, was interpreted and used as an adjective. For example, Brick—

¹ Galton, the very first experimental investigator of the association process noticed that abstract terms caused a longer reaction time than did concrete terms. This same phenomenon and the further one that there was a difference in the reaction times with the main verbal forms has been noticed by nearly every other experimenter in this field. Among other results showing this variation might be mentioned those of Cattell, Saling, Wreschner, and Jung.

Wall, Apple—Pie. The interesting thing about this fact is, that in all but four of the thirty cases in which this happened, the adjectival use of the substantive was accompanied by an average reaction time shorter than the average reaction time to the noun stimuli interpreted and used as nouns. Furthermore, this average, noun-adjectival reaction time approximated—in all but seven of the twenty-six cases—was actually less than the average reaction time to the stimuli given as adjectives and adverbs. Moreover, in three of the four cases in which the noun-adjectival average reaction time was longer, rather than shorter, than the noun average reaction time, the modifier average reaction time was also longer than the noun average reaction time. If one cares to look at the same facts from a slightly different angle he may turn to Table B-3. Here he may make a comparative study of the average of all the reaction times in which any given noun has been used as a noun, and the average of all the reaction times in which this same noun has been used as an adjective. It will be found that the latter average is shorter in all but one case out of twenty. These facts show that a word commonly and frequently used both as an adjective and as a noun, when used as an adjective has a reaction time that corresponds to the reaction time of an adjective, and when used as a noun has a reaction time that corresponds to the reaction time of a noun. This further emphasizes the fact noticed in the more general study of the tables—that there is a real difference in the length of reaction times to noun and adjective stimuli.

The results of the experiments having shown that there is this difference in reaction times connected with the different verbal forms of the stimuli, there remains the question of the possibility of its explanation. Why does a noun stimulus give us a longer reaction time than does a modifier stimulus? and why does a verb stimulus give us longer reaction time than either a noun or a modifier stimulus?

Let us ask what are the main lines of association with each of these three verbal forms. Take for instance any noun, as cow. Under the conditions of this experiment the reply must

be a single word. What single words might express that which might be suggested by cow? You might think of something the cow does—eat, graze, etc.; of something done to the cow—drive, feed, etc.; of something the cow is—large, clean; of something connected with the cow—stable, milk; or any of the co-ordinates, sub-ordinates, or super-ordinates with cow. You have in all these cases the noun as the actor, verb response; the object or thing acted upon, verb response; the thing described, adjective response; or the thing conjoined or ordained with some other object, noun response. In the same manner take a verb—say, eat. It may be the reply will be the object of the verb, that which is eaten, noun response; or the object eating, noun response; the manner in which the eating is taking place, modifier response; or again an ordinate, verb response. With an adjective among the main possibilities are an object described, noun response; or one of the ordinates, adjective response.

Which of these main characteristic reactions possible for each of the verbal forms would seem the easiest for that form? It would naturally appear that the word to be responded to any stimulus would be the one that would most naturally and logically follow after the stimulus word. We are continually expressing ourselves in speech and in writing. Even our unexpressed thoughts tend to be carried on in verbal form. In all our use of language there is a natural sequence, probably of thought, and quite clearly of words.

In the English² language this *habitual* order is *always* an

² Herbert Spencer (Philosophy of Style) might not be willing to admit that the natural thought order was adjective—noun, but rather the reverse, noun—adjective; yet this does not really affect our problem, even should we grant that it is true. We are dealing with the question now of the habitual word sequence in language. However, one other fact brought out by our studies might have a direct bearing on the validity of Spencer's contention that the normal thought order is noun adjective. For instance, we might ask, if this were true, then why, the subject being given noun stimuli, did we get such a small percentage of adjective responses?

If one were interested in the question of whether a noun-adjective order were more economical than the adjective noun order, he might

adjective noun order. True, even in the English language we occasionally have the inverted order, but the object of this inversion is emphasis, and the reason it emphasizes is because the elements attract the attention by being *out of* their natural, or *habitual order*. Likewise that which naturally follows a verb is an object, or a modifier, and that which naturally follows a noun is a verb.

It would seem, therefore, quite reasonable to suppose that association under the conditions of this experiment would follow the natural sequence of thought and language and that as a general rule with a noun stimulus you would have your reaction in the form of a verb; with a verb stimulus the response would be in the form of an object, noun or pronoun, or of a modifier; with an adjective stimulus the predominant form of response would be nouns. Do the experimental results bear out this line of reasoning? Only partially. As shown in Chart A, both verb and adjective stimuli show, as we would expect, a very marked dominance of noun responses, while, contrary to the natural expectations, the noun stimuli show an equally marked dominance of noun responses.³

This partial disagreement of our facts with what we would expect from the natural sequence of language may, I think, be partly explained on the following grounds. Contrary to all ordinary experience, we are here given a stimulus word in isolation from all else. In most cases, immediately upon its appearance its isolation disappears—an association has taken place. After this has taken place the result must be expressed

well find it worth while to test a number of French subjects with a given list of noun and modifier stimuli, to see whether he would get comparatively shorter reaction times than with English speaking subjects.

³ These results are contrary to those obtained by Saling and by Wreschner, experimenting independently. Saling found that adjectives and adverbs of time and place, as well as nouns, were generally associated with words of the same class. Wreschner also found that the most common reaction for an adjective stimulus was an adjective, the most common reaction for an abstract stimulus was an abstract term, and that such "symmetrical" reactions were commonest with rapid reactions.

Our results show marked dominance of noun responses to all three forms of verbal stimuli with more noun responses to adjectives than to any other form.

by a single word. Psychologically the expression in a single word of the association of which an isolated noun becomes a part is distinctly different from such an expression of the association of which an isolated modifier or verb has become a part.

The noun, ordinarily, is concrete, an entity. If the stimulus man is given, the subject immediately gets a complete idea—man. It may be a given man in a given situation, man in general, some particular type of man. Whichever it is, it is complete, it is a whole. What is the subject going to reply? He may reply with a descriptive term, or he may reply with some other part associated in this entity. Whatever he replies he must move away from his completeness to do it. This means a choosing from among possible replies, an effort to pick out some one. Moving away from completeness also means unpleasantness. All these factors naturally tend to lessen the probability of any natural sequence of verbal order being evidenced in the response which finally comes. Likewise these same factors tend to lengthen the reaction time.

The modifier, on the other hand, is the exact opposite of the noun. It is incomplete. It means nothing of itself. When the modifier stimulus appears, because of the incompleteness there is unpleasantness until the reaction takes place and completeness ensues. Thus the very incompleteness of the modifier is a goad to action. Moreover, the very same action that removes the incompleteness, at the same time usually supplies the necessary reaction word. The word dark, of itself, has no sufficient meaning, but dark something has. It is the something that makes the meaning and the completeness. At the same time it is the something that furnishes the reaction. This means the persistence of the natural linguistic sequence in the reaction word. And as a result of these things comes, of course, a shortened reaction time.⁴ Thus the difference in the length

⁴ Cattell (3) found that with the two subjects with whom he worked it took longer by 111 and 146 sigma respectively, to find an object than to find a subject for an intransitive verb, "the mind moving logically in the latter direction." He also made some experiments on a single subject and found that it took twice as long to recall a foregoing as a following month.

of the reaction times between noun and adjective stimuli, as well as the lack of the natural verbal sequences in the responses to the former and the presence of it in the responses to the latter, lies in the fact that there is a distinct psychological difference in the expression in a single word of the association that follows the perception of an isolated noun, and that which follows the perception of an isolated modifier.

That there exists the same sort of psychological difference between an isolated noun and an isolated verb is so evident that it will be unnecessary to go into a detailed explanation of it. The line of reasoning here advanced also receives strong support from the introspections of various subjects. In judging these introspections it should be born in mind that they are in no sense the result of leading questions. They are simply the answer to the question "Why were you so long?"⁵ Or, and this is equally often the case, they are the spontaneous expression of something that the subject has so keenly felt that he has needed no question to bring it out. Therefore, what this introspective material has lost in volume, it has, I hope, more than made up in being truthful and unbiased.

These first few introspections bear evidence of the incomplete character of the modifier and the verb.

- No. 1. Harmful—Savage, 3.067.
"Picture of the Savage automatic. Took me so long because was hunting for something harmful."
- No. 13. Harmful—Insects, 1.158.
"Think that I thought of what." (Harmful what?)
- No. 4. Use—What, 5.500.
"That didn't bring anything at all. Couldn't think of anything that use."
- No. 13. Warn—Warner, 2.549.
"I thought of warn who? warn what? But couldn't think of anything. Then the other came in."
- No. 13. Find—Me, 1.582.
"Thought of find what? and nothing came but me."

⁵ It is often in the longest reactions of a particular kind that the processes involved become most apparent.

- No. 19. Find—Gold, 1.097.
“Process of deliberating—find what?”
- No. 19. Expect—Praise, 1.120.
“Case of trying to think of something that people might expect.”
- No. 16. Threaten—Man, 1.368.
“Thought of who could threaten—man could.”
- No. 16. Abuse—Man, 1.698.
“Thought of abuse, and then had to think of something to abuse.”

The following example throws light upon the unpleasantness—pleasantness aspect of the incompleteness and then the completeness of a verb stimulus.

- No. 13. Threaten—To kill, 7.270.
“Was just conscious of searching. Conscious of strain of trying to get something to make sense. Also wondered if clock was running over ten seconds. Was relieved to think had found something to make sense.”

The next two give an interesting contrast between nouns and adjectives. The third shows the importance of the natural linguistic order while the fourth speaks for the *completeness* character of the noun form.

- No. 4. Costly—What, 1.038.
“Just give me a word—don’t mean anything. Give me a noun and it means something; an adjective or a verb simply means a question.”
- No. 19. Farmer—Horse, 1.607.
“Word farmer there does not form phrase like those words that go to make up compound words, or as adjectives do. Takes a little longer to think of something that goes with farmer.”
- No. 19. Purpose—Good, 1.506.
“Good purpose. Couldn’t think of any word to follow purpose. When I have to turn it around that way it causes delay.”
- No. 22. Lake—Whitmore Lake, 1.523.
“Thought of just lake in general at first.”

No. 4 and No. 7. These two subjects very frequently gave as a response some interrogation. An interrogative response

following a stimulus word is the most direct and clear statement of the nature of the mental process started by that stimulus. The fact that in these two cases there were so many more of this kind of response to verb and modifier than to noun stimuli, emphasizes the *incompleteness* character of the former as contrasted with the *completeness* of the latter. The per cent of these interrogative responses were for No. 4; concrete nouns $7\frac{1}{2}$ per cent, verbs 30 per cent, modifiers 14 per cent, abstract nouns 0 per cent. For No. 7; concrete nouns 0 per cent, verbs $6\frac{1}{2}$ per cent, modifiers 4 per cent, abstract nouns 10 per cent.

All the evidence so far seems to support the theory that modifiers and verbs are alike in the nature of the psychological process which they stimulate, while the noun is different from either of them. If this difference between noun and modifier stimuli is used to explain the greater length of reaction time with the noun stimuli as compared with the modifier stimuli, are we not to expect, on the same grounds, that noun stimuli would have a longer reaction time than verb stimuli, and that the latter would have a reaction time corresponding to the reaction time of modifier stimuli?

This, indeed, would be the logical conclusion from the facts so far presented. However, there is one important way in which verb stimuli differ from both noun and modifier stimuli. The verb stimuli have a greater percentage of distribution of responses than have the other two forms of stimuli. By the percentage of distribution of responses of a stimulus is meant the per cent of different responses which that particular stimulus called out in the entire number of subjects tested. For instance, with the stimulus Provide there were 14 different reaction words given by the 30 different subjects. The percentage of distribution was then, in this case, $46\frac{2}{3}$.

In Tables B-1, B-2, B-3, we have respectively the verb, modifier, and noun stimuli together with their percentages of distribution of responses. In each of these tables the stimuli are arranged according to the length of the average of all the reaction times to the individual words. Glancing down the columns of percentages of distribution we find this relation holds for

each of the three verbal forms—the majority of the high percentages of distribution of responses are in the upper third of the column, the majority of the medium percentages are in the middle third of the column, and the majority of low percentages are in the lower third of the column. In other words, with a gradual decrease in the length of the average reaction time we find a corresponding, though not a uniform, decrease in the percentage of distribution of responses.

A further study of these three tables shows that in nearly all cases in which five or more subjects have responded with the same word to a given stimulus, the average of the reaction times for these responses is less than the average of the reaction times for all the other responses to this stimulus. In the case of verb stimuli this is true in $77\frac{1}{2}$ per cent of the 40 cases, with an average saving in reaction time for each of the 40 cases of 239 sigma; with modifier stimuli it is true in 85 per cent of the 54 cases, with an average saving of 319 sigma; with concrete nouns it is true in 100 per cent of 23 cases, with an average saving of 327 sigma; with abstract nouns it is true in 100 per cent of 4 cases, with an average saving of 242 sigma.

A small percentage of distribution of responses really means that a large number of people have the same association complex aroused by a given stimulus; also that they tend to express the common complex by the same word. Windy is probably (at least as far as our results show) more commonly associated with day than with any other word. The fact that so many people associate these, or any two words, together means that any individual who has that association at all has it very frequently. He continually hears other people using it, and is continually using it himself. Thus when the stimulus word windy is given the response day will be apt to come quickly for two reasons. First, because it is the habitual association and those association paths most frequently used are the ones most readily used. Secondly, because of the dominance of this association no other associations have a chance to start to form. The following introspections throw some light upon this problem, and also show that with those stimuli with which there is possible

a large number of responses we do actually get a lengthened reaction time, over the average of that class of stimuli.

- No. 20. Ripe—Berry, 2.748 (1.648)⁶
 "Didn't know what to apply ripe to, are so many things."
- No. 20. Fail—Exam., 2.039 (1.839)
 "Kept saying, fail, fail. Why there are so many things you can fail in. Then thought of exam. as the most appropriate thing for this occasion."
- No. 22. Pleasing—Joke, 1.217 (.981)
 "More the idea of story than of joke. So many pleasing things to think about, couldn't settle down down to any one."
- No. 25. Nice—Candy, 1.371 (.749)
 "Thought of about two dozen things."

If we look at the matter introspectively for ourselves, I think we shall feel that, at least so far as modifiers and verbs are concerned, there will be little doubt as to which we more habitually associate with certain things.

In Table C we have verb, modifier, and noun stimuli respectively, together with their general averages arranged according to their percentages of distribution of responses. Grouping in each of the three forms of verbal stimuli all those words whose percentages of distribution of responses falls between 80 and 100 per cent, 70 and 80 per cent, 60 and 70 per cent, 50 and 60 per cent, 40 and 50 per cent. and 10 and 40 per cent and averaging the total average reaction times for each group (Table C), we find that with but three exceptions the average of each lower group of percentages of distribution of responses is lower than that of the group just above it. In the three cases in which exceptions to this rule are found, one of the two groups compared contains only a very few stimuli averages, viz., 3, 4, and 6 respectively. Probably with a sufficient number of stimuli averages in each group, to make the situation at all representa-

⁶Numbers in parentheses are average reaction times for the particular class to which the given case belongs. In this particular example it is the average reaction time of this subject for all the noun reactions to adjective stimuli.

tive, the rule would be absolute. This serves, then, as further evidence of the influence of percentages of distribution upon lengthening reaction times.

The chief significance of the facts presented in Table C is expressed diagrammatically in curve C_a . This curve shows that there is a very close similarity between the percentages of distribution of responses of noun and modifier stimuli. The curve for these two forms very closely approximates on the ends, and in both cases their apex falls in the central region of 50. On the other hand the verbal curve shows a widely differing distribution. With verb stimuli the maximum diversity of response is higher than that of either the nouns or modifiers, while its minimum is considerably lower.

We have, then, from the evidence furnished us by the introspections and by these variously tabulated results the following specific facts:

(1.) Nouns and modifiers have very nearly the same range of percentages of distribution of responses (for definition of percentage of distribution of response see page 22), but are unlike psychologically.

(2.) Modifiers and verbs are alike psychologically, but verbs have a very much higher percentage of distribution of responses.

(3.) High percentages of distribution of responses are accompanied by lengthened reaction times.⁷

⁷As bearing on the particular point in question a part of the results of Wreschner are of especial interest. He repeated the free association test sometimes on as many as 8 different occasions (always with at least a week's wait between each series) with the same stimuli words and the same subjects. With the 3,338 results that he obtained he found that with adjectives there was the greatest tendency for the same subject to reply with the same word on the different tests, and that with abstract nouns there was the greatest diversity of response. If we consider in this connection the further fact that with his adjective stimuli Wreschner got reaction times ranging from 1,709 sigma to 2,328 sigma, while with his abstract nouns his results varied from 2,028 to 3,415 sigma we will find support for the view that long reaction times are connected with diversity of reaction.

Wreschner further finds that while with the first two or three repetitions of the reaction word there is a retardation in the reaction time, this is followed later with an increasingly great diminution of that time. He suggests that the retardation is due to the occurrence to the subject's mind of new responses, while the acceleration is due to the recurrence of the old response. If his suggestion be true, then we have reason to say, in terms

(4.) The character of completeness of which nouns partake tends to retardation of reaction times, while the character of incompleteness which characterizes modifiers and verbs tends to decrease the length of reaction times.

From which we may conclude that the difference in the length of reaction times between nouns and modifiers is due to the psychological difference in character of reacting, under the conditions of this experiment, to an isolated noun, and to an isolated modifier stimulus, while the greater reaction times of verbs is due to the psychological influence of the possibility of reacting in a large number of different ways, as evidenced by a high percentage of distribution of responses.

OTHER FACTORS INFLUENCING REACTION TIME

The discussion and facts just given show that the verbal form of the stimulus has a very decided effect upon the length of the reaction time. There are other factors at work, however, whose influence, while not so constant and calculable a force, is of decided importance in the consideration of the question of the length of reaction times. Since, for reasons above pointed out, it was decided to rely upon spontaneous, or at least, unguided introspection, it was impracticable to compile any concise tables in regard to these other influences. However, the cases cited as examples of each such influence are sufficiently numerous of the theory that we have advanced, that the occurrence of the new responses tends to inhibit the old response, but that since this response has once been made it has increased strength and, *in time*, overcomes the inhibition.

Also in close keeping with this theory is the fact that controlled associations—other conditions being equal—are shorter than free associations. In other words, the same result in regard to length of reaction time is obtained whether the limitation of the number of possible associations is natural (the inhibiting of other associations by the strength of some one association) or artificial (the limiting of the number of possible associations by a set condition governing the nature of the reply). Wreschner found, not only that this was true, but that the smaller and more definite was made the field of possible response, the shorter the reaction time became. For instance, the naming of a country which contained a given city required an average reaction time for the subjects with whom he worked of 1,535 sigma, while the naming of any city required 1,665 sigma; naming the author of a given book required 1,737 sigma, naming any book of a given author required 1,968 sigma.

and sufficiently striking to remove any doubt as to their real power.

Of these other influences affecting length of reaction times, one of the most important is the tendency of the subject to visualize. The results of our experiments, while they can not be definitely tabulated, indicate that as a general rule the coming, with the appearance of the stimulus, of a visual image tends to retard the reaction.

There are two general classes of visual imagery. There is a simple imagery, where nothing appears in the picture save the isolated image, generally of the object representing the stimulus word. There is a complex imagery, in which the picture represents a complete situation. In either case the natural result is retardation of reaction time. The coming of the simple image necessitates the finding of some word, other than the stimulus word to represent the image, or some part of it. The complex image necessitates, either the extremely difficult task of finding a word to stand for the total situation presented by the image, or, and this is more often the case, the selection (and selection involves time) of some part of the presented picture and the replying with the word suitable to this selected part. Furthermore, the very fact of the natural image response often tends to inhibit the coming of any word response.

The following examples illustrate the influence of both the simple and the complex types of imagery. The comparison of the reaction time of each particular stimulus with the average reaction time for stimuli of that class (given in parentheses) clearly shows the retarding effect of the visualization.

- No. 2. Ear—Lobe, 4.764 (2.688)
“Image of ear comes almost at once. Took some time to pick out what was going to say.”
- No. 3. Activity—Mental, 1.667 (1.030)
“Image of a student at a student’s table. When I see those images the word don’t come.”
- No. 3. Prison—Chains, 3.075 (1.324)
“Nothing came up. Had a vague picture of the prison first, but nothing to express it.”

- No. 13. Angel—Cake, 2.123 (.985)
 "Saw an angel standing in space, twenty or thirty feet up in the air. Couldn't get any word. Kept thinking angel, till the word cake dropped in, then the angel went."
- No. 4. Lamp—Brazier, 3.093 (1.305)
 "Just saw it straight ahead. Kept saying lamp, lamp. Didn't anything else come, that's all."
- No. 22. Farmer—Hay, 1.707 (1.096)
 "Picture of a farmer with a big straw hat and hay in his mouth. Had to look him over to find what to say."
- No. 23. Ragged—Pants, 2.172 (.879)
 "Didn't know whether to say boy, pants, or street urchin. Had a picture of a street urchin standing on corner. Pants the emphatic part of it."
- No. 28. Greasy—Dishes, 2.315 (1.048)
 "Saw Hamburger (lunch counter) over here—couldn't get *one* word to come."

Instances such as the two following may indicate that visual imagery is less apt to cause retardation with modifier stimuli, where the imagery may suggest the response, than with noun stimuli, where the image is often the picture of the stimulus word itself.

- No. 2. Green—Grass, 1.212 (1.948)
 "Saw blades of green grass."
- No. 2. Watch—Gold, 7.033 (1.749)
 "My own watch suspended in space. No descriptive word came to me."

On the other hand with two or three of the subjects there seemed vague indications that the imagery was an aid rather than a hindrance to the forming of the verbal association. The conditions were not such, however, as to give any clear evidence that this was the case. The subjects giving such indications were individuals having a narrow association range. That is, words did not seem to call up other words. In such cases, it may well be that the image aids the reaction by suggesting an association that would come about in no other way.

This all raises the question of whether the image comes after the verbal association, thus expressing it; or before the verbal

association, in which case the imagerial association is expressed by the verbal. If, as in a few cases, the individual gets his cue for the verbal association from his visual image, then the appearance of the image before the verbal association, is an aid to the association, otherwise it is a hindrance and causes retardation in the reaction time. It is well nigh impossible for the ordinary subject to discriminate truthfully the sequence of imagerial and word association. Often the subject, especially where the reaction has been very short, is at a loss to know whether the image came before or after the actual reply. Hence it is impossible to draw more than very broad generalizations upon this point.

Oftentimes a stimulus word half calls up a number of ideas, thus causing a general feeling of confusion. This is opposed to short reaction times.

No. 8. Red—Paper, 2.193 (1.326)

“Very confused—most confused have had yet. Was a number of things seemed on the point of saying. One was red sock. Don’t remember any other. Seemed as if would have to pick one. Looked at the card in front and said paper.”

No. 29. Hat—Picture, 2.439 (1.390)

“I want a new hat—and Easter, all those things came up together.”

No. 32. Tiresome—Work, 1.846 (1.467)

“Confusion, muddle—didn’t get anything.”

Closely linked with confusion as a cause of retardation is the case in which the stimulus word calls up some situation or idea that it is difficult to express in a single word.

No. 13. Negro—War, 3.026 (1.470)

“Thought in general of negro servitude, but couldn’t get any word to express the idea.”

No. 20. Poor—Old, 1.836 (1.410)

“Poor suggested something not up to standard. No particular word for it. Standardized that particular suggestion by old.”

- No. 20. Find—Give, 3.796 (1.617)
 "Word reminded me instantly of article read in newspaper a few days ago of a fellow who found a valuable purse. No word to represent this, until thought of what he ought to do—give it back."
- No. 21. Mattress—Bed, 1.442 (1.002)
 "Some trouble there. Got the idea of house first. Idea of house as a whole; living apartment, or something like that—not the word house."
- No. 21. Music—Hall, 4.453 (.888)
 "Was confused there. Started to think of English class, teacher, and certain situation all together. Had to go from that because was too much."

Often times there is not a mere suggestion, but a marked tendency for two or more associations to be formed. Each one of these serves as a natural inhibition to the other and a delayed reaction time is the result. This tendency is often characterized introspectively as a "struggle."

- No. 13. Costly—Dress, 3.172 (1.077)
 "Was another word crowded in there. Wasn't so clear. Think it was apparel. Thought it, but Couldn't speak it—couldn't formulate it."
- No. 13. Possess—Wealth, 2.083 (1.466)
 "Were two or three ideas trying to get in. One almost thought had, but didn't. Was searching. When search the same idea never comes back again."
- No. 13. God—Help, 1.899 (1.115)
 "Just a sort of struggling again. Three other indefinite impulses that was conscious of. Seems to me now that bless was one of them."
- No. 19. Prison—Cell, 1.424 (1.005)
 "Bar and cell both struggling for expression."
- No. 19. Weary—Man, 1.026 (1.005)
 "Word wanderer coming in to interfere with it."
- No. 19. Harmful—People, 1.917 (1.005)
 "Thought of word man too. More or less of a struggle for the expression of the two thoughts."
- No. 20. Pick—Berries, 2.155 (1.839)
 "Saw an old strawberry patch at one end of the garden. Seemed to suggest almost simultaneously

another thing. We used to go off to the hills to pick cherries. Couldn't think whether to say cherries or berries."

Two very related groups of introspections bearing on the cause of long reaction times are those that give as the cause of the delay the fact that there is a "Blank"—no association comes, and those that say the association comes only after a process of "searching."

Blank:

- No. 13. Tiresome—Laboratory, 3.826 (1.403)
"Why so slow; my mind a blank. The most tiresome thing I could think of was a laboratory."
- No. 6. Heart—Flesh, 2.322 (1.011)
"Can't figure out how I got that. Sort of a vague search you might say."
- No. 8. Star—Player, 2.117 (1.203)
"Word didn't suggest anything at first."
- No. 9. Skilful—Ability, 5.808 (2.328)
"I couldn't think of anything. Just can't. My mind is a perfect blank this morning."
- No. 17. Star—Moon, 5.767 (2.642)
"Didn't think of anything."
- No. 24. Goat—White, 1.735 (1.100)
"Just nothing—just blank. Just isolated and then realization that it was isolated."
- No. 30. Conclude—Time, 2.135 (1.079)
"Don't know why said it. Couldn't think of anything."
- No. 32. Tearful—Girl, 9.464 (1.467)
"Absolute blank! Didn't get a single thing. Then saw a particular girl crying."

Searching:

- No. 13. Boisterous—Waves, 1.728 (1.077)
"Just searched until the word came. About three things started to come in before, but didn't come very far."
- No. 13. Gather—Wool, 2.771 (1.466)
"Was searching for a word and finally that came. Thought wool gathering."
- No. 13. Receive—Help, 1.710 (1.466)
"Just a searching there; couldn't get anything tangible to say."

Occasionally, also, the length of the word seems to have an influence upon the length of the reaction time.

- No. 16. Consideration—Aton, 2.565
 “Was a longer word. Had to look to see what it was.”
- No. 22. Sincere—Friend, 1.196 (.981)
 “Stop to read test word more carefully because was long. Didn’t want to make mistake as I did on imitate.”

Finally, we see that there is some evidence, also, of the influence of emotion and of conscious inhibition of the natural association.

Emotion:

- No. 25. Excitement—Ran, 1.133 (.896)
 “Got a picture of a riot in which the excitement ran high. Lots of people all mixed up. Feeling that didn’t want to get hurt. Then thought of place where was last year. Thought that I was going to get killed. Was on a high dark R. R. bridge near a station. Thought was going to get thrown off. Found myself there again.”
- No. 29. Tearful—Me, 1.960 (1.286)
 “Was conscious of a particular condition about three years ago.”
- No. 29. Decision—Hard, 1.397 (1.851)
 “Called up a certain unpleasant situation before I spoke. Was about three or four years ago.”
 (This the same situation as in the preceding case.)
- No. 29. Policeman—Jump, 2.384 (1.533)
 “Feeling of fear, just as if saw a policeman coming. Have a kind of awe of them yet. Used to be afraid if saw one a mile off.

Conscious inhibition:

- No. 13. Admire—Dewey, 2.423 (1.466)
 “First thing that popped into my head was me. That I rejected. Searched around for something more suitable. Think I said Dewey because have been reading a book about Dewey and the Spanish war to my boy.”

- No. 13. Hell—And damnation, 1.870 (1.470)
 "Felt that shouldn't say it."
- No. 13. Suck—Mother, 2.829 (1.466)
 "Thought that was a little rank. Tried to think of something else. Saw an infant doing it."
- No. 15. Lawyer—Liar, 4.063, (1.555)
 "Thought of that before, but tried to think of something else."
- No. 20. Take—Steal, 3.783 (1.617)
 "I started to say leave and it flashed on my mind that that was not appropriate as had already said it once. Searched for a new word."
- No. 22. Purple—Dress, 1.798 (.981)
 "Didn't want to say it. Hesitated after the word came."
- No. 27. Suck—Eat, 1.833 (1.057)
 "Saw baby at mother's breast. Didn't like to express it."
- No. 29. Pleasing—Me, 3.146 (1.286)
 "Didn't say me as soon as came—Didn't want to."
- No. 31. Suck—Fruit, 1.625 (.755)
 "Think lemon the first thing that came. Sounded foolish."

When two words are frequently or habitually used together, they become the same as one word. Then the first part is almost sure to call up the second. We have a vocal motor habit established. Practically *no* thought is required. After the vocal processes commence their action on the first part of this combination they unconsciously continue it until the entire combination (which includes the second word) has been formed by them. Thus we might expect as the result of this motor response a marked reduction in the reaction time.

- No. 7. Friendly—Man, .707 (1.035)
 "Just popped right out."
- No. 13. Accept—My thanks, 1.139 (1.466)
 "Came into my mind like a flash. That is sort of a pet phrase of mine in closing a business letter."
- No. 13. Farmer—Friend, 1.032 (.985)
 After the subject had replied a very surprised expression came over his face. He said, "I didn't think at all, feel as if alliteration had something

to do with it." In another introspection he says, "Have a tendency to use a good deal of alliteration in my writing. I find it in my papers after I have written them."

No. 13. Greasy—Grind, .846 (1.077)

"Nothing there before I said it, but remember now of having said that in some connection a day or two ago."

No. 19. Learn—Books, .883 (1.230)

"Nearly cut it off in the middle because I saw that it was not the proper expression. Was an expression that when I used to teach school twenty-five or thirty years ago was quite common with the parents."

TESTS OF FORMS INFLUENCING REACTIONS

Direct and Indirect Forms

Having finished our discussion of the main point in our inquiry—the question of the causes of variation in the length of reaction time—we come now to the question of the effect of control or influencing factors upon reaction and reaction time. Taking the various forms suggested, in the order in which they were mentioned in the introduction, we will first consider, in their various aspects, the importance of the *direct* and the *indirect forms of influence*.

In regard to these two forms we have three questions to consider. (1) Is one form more successful than the other in exerting influence over the response to the second of the two stimuli? (2) Do we find any difference in the length of the reaction time when we have the two different forms of influence? (3) How do the reaction times of each form of influence compare with the general reaction times of the different subjects?

In the finding of answers to these questions we will refer to tables D-1 and D-2. The results there presented may be looked at in two different ways. We may study the per cent of the apparently successful control and the relation of the reaction times of the two forms in each individual case of the thirty cases tested, and we may compare the reaction times and per cents of success of each of the ten pairs throughout the cases in which

they each appeared in the *direct form*, with those cases in which they each appeared in *indirect form*. In regard to this latter method it is to be regretted that there was not a more even distribution of cases for each of the two forms. However, since the results so closely agree anyway, it would probably make no difference in the general conclusions if the division had been more even. As it stands now, each pair was used in one form only seven times, while it was used in the other form twenty-three times.

Summarizing the results of Tables D-1 and D-2 according to the first method we find that out of the five pairs that appeared in *direct form* for each individual of the thirty individuals tested, there was an average of $2\frac{1}{3}\frac{2}{0}$ pairs in which the reaction to the second stimulus of the pair was the same word as the first stimulus of the pair (that is a successful influence); while out of the five pairs that appeared in *indirect form* for these same thirty individuals the average, for the same results, was $2\frac{1}{3}\frac{1}{0}$ pairs. The distribution of the number of successful controls by both *direct* and *indirect* forms over the thirty cases is shown by curve D_a.

Out of the thirty cases there were 6 in which one form or the other was entirely unsuccessful. This leaves 24 cases in which we can compare the average reaction times of the successes of the *direct* and *indirect* forms. In 17 instances, or 70% per cent of these 24 cases the reaction times of the successful *indirect* forms were shorter than the reaction times of the successful *direct* forms. But if we spread the saving in reaction times of the *indirect* over the *direct* forms over the entire 24 cases we will find that it amounts to only 139 sigma per case.

Summarizing the results of the same tables according to the second method mentioned, we find that there are 7 of the 10 pairs appearing throughout the 30 cases that have a greater percentage of successes when appearing in their *direct* then when appearing in their *indirect* order. But the excess of influence of *direct* compared with *indirect* when distributed over the 10 pairs amounts to only 7 per cent per pair.

There are 6 pairs out of 9 (one pair, No. 5, having no influence in the *direct* form) in which the average successful reaction time of the pair is less when it appears in its *indirect* form than when it appears in its *direct* order. But the total saving in time of the *indirect* over the *direct* order amounts to an average of only 75 sigma for each of the 10 pairs.

No matter in which of the two ways we look at the results we find that the same thing holds. In regard to percentage of successes we find, that both for the different pairs in the individual cases, and for the same pairs throughout the 30 cases, the *direct* has an advantage over the *indirect* form. This advantage, however, is so slight that it is of no practical significance. In regard to the length of the reaction times we find, both for the different pairs in the individual cases and for the same pairs throughout the 30 cases, that the *indirect* has an advantage over the *direct* order. But here, again, this advantage is too slight to be taken as indicating any vital difference between the two orders.

Therefore, from these results we may conclude that the *direct* and *indirect* forms are practically on a par, both as regards the influence of the first stimulus of the pair upon the reaction to the second stimulus of the pair, and as regards the length of the reaction time of those cases where the influence has been shown. However, curve D_a would seem to indicate that in respect to the evenness of distribution of successful influence the *direct* form has the advantage. There are fewer pairs of the *direct* order that have an extremely high or an extremely low number of successes. Twenty-one cases out of the 30 have either 2 or 3 successes; only 6 have less than 2, and only 3 more than 3 successes. With the *indirect* form, on the other hand, there are only 10 cases out of the 30 that have 2 or 3 successes, while there are 11 having less than 2, and 9 having more than 3 successes.

In answer to our third question Tables D-1 and D-2, show that with the *direct* form of influence the average of the reaction times in those cases in which the influence worked are less than the general reaction times of the respective subjects

in 75 per cent of the cases and that the *indirect* averages are less than the general averages in 96 per cent of the cases. Our previous comparison of the relation of the reaction times of successful *direct* and *indirect* forms indicates that the difference of 21 per cent here shown, is of no significance. The one thing that really is significant is the fact that in a considerable majority of cases the average reaction time is less with the successes in these control forms than the general average reaction time for all other forms.

And Form

In testing the *and* form of influence we have this problem: If we take two substantives that are commonly joined together by the conjunction "and" and use the second of these as a first stimulus, and immediately following use the first substantive together with the conjunction "and" as a second stimulus, then will the response to the second of these two stimuli be influenced by the first stimulus and the conjunction "and" that has been added as a part of the second stimulus? In tabulating the results each case in which the response to the second of the two stimuli was the first substantive used as a stimulus was called a case of successful influence.

There also arise two questions regarding the lengths of the reaction times in these cases. Will the average reaction times of the successful influences of each pair be greater than, or less than, the average reaction times of the unsuccessful influences? What will be the relation of the average reaction time of the successful and the unsuccessful influences in each of the thirty subjects to the general average reaction time of these subjects.

By examining Table E we find that there is considerable evidence that the *and* form of influence does exist, although a glance at curve E_a will indicate that the range of the successful influences for the different pairs of stimuli is very wide, while curve E_b shows an equally wide variation of successful influence when looked at from the individual standpoint, although the average number of successes per individual is relatively high—7.33 out of a possible 10. This wide variation of suc-

cessful influence together with the facts given in Table E_c, showing the distribution of responses in the cases where the influence was unsuccessful would lead one to believe that of the two things—the preceding stimulus word and the conjunction “and” which follows the second stimulus word—it is the latter which plays by far the greater part in the control of the association to the second stimulus. It is apparently the conjunction “and” that influences the association, and that influence extends beyond the limits of that which we postulated here as a successful influence. What the “and” really did in most of the cases was to call up the substantive that was habitually associated by the individual subject with the substantive to which the “and” was connected as stimulus. The most striking example of this is in the pair No. 2 Milk, Bread and. In selecting this combination as one of the ten pairs to be used I considered that I was choosing words that would be immediately associated together by practically everybody. The reason for this was, probably, that all through my own life bread and milk had been strongly linked together, while bread and butter, due to individual taste, had not. But my experience evidently had not been the experience of the majority of the subjects used in this experiment, for in this particular case there was an actually greater percentage of the reply “Butter” (43 per cent) than of the reply “Milk” (40 per cent). The introspections of the subjects also bear out this idea that it is the conjunction “and” plus the experience of the individual subject that is responsible for the reaction. No. 8 for the stimulus “Bread and” reacted with “Butter” and gave the following introspection, “Saw a glass with a piece of bread sticking in it. Don’t know why on earth didn’t think milk, but thought butter. Didn’t have any inclination to think milk.” No. 4, who had been ill for several days just preceding the experiment reacted to the same stimulus with the word “Water” and said, “That’s what I’ve been eating for a day or two.” Again with the pair “Pork and,” one of the three pairs having the highest percentages of successes, we still find introspective evidence of the same character as that just given. No. 14 replied “Beans” and said, “Just came naturally.

Anybody who works in a hotel or anybody who orders it—it would be that way.” Right along this same line of thought is the introspection of No. 20, who also replied “Beans.” He said, “I couldn’t have thought of anything else. Didn’t think of the preceding word at all. That’s what you see on the menu card, always.” No. 16 replied “Beans.” His introspection was, “Supplied the other word; generally see the two together.”

Another factor that probably plays an important part in determining whether or not the influence of the *and* form is to be successful is the sort of ideational complex or system that is called up by the first of the two stimuli given to the subject. If this system be of such a character that the second of the two stimuli does not readily fit into it there is reason to believe that there will result an inhibition of the association of the first stimulus, with the second stimulus, and hence a case of unsuccessful influence. If the system is such that the second stimulus does fit into it, then the association of the first stimulus with the second stimulus will be aided.

As an example of the first kind, where inhibition results, we have stimulus, Rolls; response “Roly-poly.” The individual had a picture of the toy roly-poly. Consequently when Coffee *and*—was given as the second stimulus the subject already had a system in consciousness into which this second stimulus did not fit. His response was not Rolls, but Tea. On the other hand, with the stimulus Beans the reply “Baked” would generally imply a complex into which the second stimulus, Pork *and*—would readily fit. And the results of the three cases in which the stimulus Beans did bring the response “Baked” show that this supposition is probably true, for all three subjects replied “Beans” when Pork *and*— was given as the following stimulus. It must be remembered, however, that there are no doubt cases in which the motor habit formed by continually associating such words as Pork and Beans would bring out the response Beans to the stimulus Pork *and*— even though the first of the two stimuli had aroused an associational system that would tend to inhibit this association from taking place. Such, for instance, is the case of the subject who replied to the stimulus

Beans with "Bean family at home," yet to Pork *and*— replied "Beans."

This is simply a case of motor habit being stronger than the inhibitory character of the association complex aroused by the first stimulus. And the fact that the influence is successful as judged by the reply does not really indicate that there was any influence of the first stimulus word causing the reaction to the second stimulus to be what it is. Nor does it in any sense indicate that the second stimulus became a part of the complex aroused by the first stimulus, but rather that there is merely a motor reply, often without any parallel ideational content. This is evidenced by such expressions in introspection as "Purely automatic," "Just dropped out," "Couldn't get anything else," and others of a similar nature.

The point to be here emphasized is, that there is much reason to suppose that association is something more than a re-arousal of cerebral cells that have already been excited together. It is a process of inhibiting the passage of nervous excitation from and to one or more groups of cells as much as it is the actual passage from and to other such groups of cells. Association is of this double character, transference of excitation, and inhibition of excitation.⁸ As this part of the experiment was not designed to test this particular point, its mechanism did not give results that can conclusively settle the question one way or the other. But the results do suggest the probability of such a conclusion.

The possibility of the successful or unsuccessful character of the *and* form of influence affecting the length of the reaction time to the second of the paired stimuli still remains to be considered. A measure of this effect is given by taking the average of all the reaction times accompanying successful influences for a given pair, and comparing this average with the average of all the reaction times accompanying unsuccessful influences for this same pair. By such a method it was found that for 9 of the 10 pairs used the successful influences gave shorter reaction times

⁸ Shepard and Fogelsonger: Studies in Association and Inhibition. *Psychological Review*, Vol. XX.

than the unsuccessful influences. The amount of this saving in reaction time averaged 438 sigma for each of the 10 pairs.

Looking at the individual subjects we see that the average time of the successful influences is less than the general average reaction time in 93 per cent of the thirty cases; that the average reaction time of the unsuccessful influences is less than the general average reaction time in 60 per cent of the cases; and that the average of the reaction times of both the successful and unsuccessful influences together is less than the general average reaction time in 90 per cent of the cases. These consistently high percentages lead us to believe that the "and," whether it suggests one word or another, by the very fact that it is there does serve to suggest some word, and that suggestion by limiting the number of possible reactions to one or two responses shortens the reaction time. The presence of the "and" also changes the character of the stimulus from one of completeness to one of incompleteness, and we have already seen that a stimulus incomplete in character gives a shorter reaction time than does one complete in character.

PRECEDING VERBAL FORM.

Judging from the Tables, F-1 and F-2, together with their summary Table F_a we must conclude that the preceding verbal form does not influence the interpretation of immediately following ambiguous verbal forms. We see, in fact, in the total of ten such ambiguous forms a greater percentage of interpretations as nouns when the preceding definite form was a verb than when it was a noun. There is but a single case, that of No. 3, that gives any real evidence of influence of preceding verbal form. There are but three of the ten ambiguous forms, Pick, Boil, and Stand, that were not predominantly interpreted as nouns. These three words are probably used much more commonly in their predicative connection than in their substantive relation. It is probably due to this habitual form of use that we have them so interpreted in this experiment. This view is supported by the fact that it so happens that they were interpreted as nouns in a greater percentage of cases when they were

preceded by verb forms (43, 43, and 57 per cent than when they were preceded by noun forms (35, 22, and 39 per cent.) Since this fact holds for all three words it would lead us to seriously question the possibility of the interpretation being influenced by the preceding definite verbal forms. That there is variation, as shown by the tables, in the manner in which various subjects interpret the same form under the same preceding verbal conditions would also lead us to suppose that it must be some individual factor such as habitual use or particular experience that leads to the particular interpretation. Any recent or vivid experience may thus, in the individual case, be the dominating factor in the interpretation. The evidence for this kind of influence is strongest when we have a stimulus, like *boil*, generally interpreted as a verb (73 per cent), interpreted as a noun with the introspection by the subject that it made him think of a big *boil* that he had just had on his neck.

Summarizing Table F-1 and F-2 we find that there are 5 reactions that were failures. This leaves 295 reactions to ambiguous forms. Of these 295 reactions, 195 were interpretations of the ambiguous form as a noun. But this fact is even more striking when we state that in over half (110) of these cases the ambiguous form was preceded by the definite verb form.

It is probable that we use substantives in isolation more than we use verbs in isolation, and hence are more apt to interpret these indefinite forms as nouns. If this be true, it goes back again to the theory of interpreting stimuli according to the way in which they are habitually perceived and used.

PRECEDING CONDITION

The detailed results of the experiments testing the influence of a given preceding condition upon the reaction to the stimulus word immediately following this statement of condition are given in Table G. Out of the possible 130 reactions obtainable, only 117 were secured. Of this number there was evidence, either in the reaction word itself, or in the introspection, of the influence for which we were testing in 82, or 70 per cent, of the cases. The percentage of successes for each of the five words used is

as follows: Nationality 67 per cent, Tom 75 per cent, Organ 82 per cent, Brush 52 per cent, and Shrill 70 per cent. For each subject there was obtained an average of 3.9 reactions under this kind of condition, while the average of successful influence for each subject was 2.73.

The most interesting part of this test is shown in the reaction times. There were fourteen subjects whose average reaction times to those stimuli over the response to which the previous condition did exert an influence, were longer than their general average reaction times by an average of .334 for each of the fourteen cases. There were also fourteen subjects whose averages for those stimuli under the same conditions were less than their general average reaction times by an average of .491. This, however, makes an average saving for the twenty-eight subjects of only .028.

There were likewise nine subjects whose average reaction times for those stimuli with which the preceding condition did not influence the reaction were longer than their general average reaction times by an average of 1.239 per subject. Of the ten whose average reaction times for those stimuli were shorter than their general average reaction times, it was so by an average of .310, making an average increase for each of these nineteen cases of .424.

The interest in these figures is chiefly in the bearing they have upon the inhibition character of association. From this point of view two facts are of prime importance. First, the decidedly lengthened character of reaction (average of 1.239 for each of the nine cases) with which the unsuccessful influence on response is accompanied. Second, the fact shown by the table, that whenever there is a lessening of the reaction time with the successful influence it is generally (though not always) a decided lessening. These facts would warrant us in saying that when the complex aroused by the condition is not such an one that the following stimulus word will fit into it, then this condition causes a decided inhibition of association reaction; but when this complex is favorable then it causes a decided shortening of the time required for this process. It is true, even in those cases in which

the influence of the condition is successful, that the very newness of the condition under which the subject is reacting may cause a retardation of reaction time. Thus we have explained the fact that there are as many cases in which the successful influence requires a longer reaction time as there are cases in which it requires a shorter one. But we must notice that this reaction time is never above a second longer, while the shortened reaction time is above a second shorter in three different cases.

III. CRIMINAL ASSOCIATION TESTS

DISCUSSION OF THE METHOD

The second part of our work consisted in testing experimentally the applicability of the association method as a means of determining the guilt or innocence of an individual suspected of a criminal act. In the series of experiments that were performed for this purpose we made use of the same group of students who had already acted as subjects in our first series of experiments. A double advantage was thus attained. We had subjects who were familiar with the mechanical details of the experimental method employed, and were consequently acting under familiar conditions. We also had at hand from the preceding tests, for each subject to be tested for the presence or absence of guilty knowledge, data showing the average reaction time for each of the verbal forms of reaction (noun stimulus—adjective reaction; noun stimulus—noun reaction; noun stimulus—verb reaction; etc.).

The impracticability of having any of the subjects actually commit a crime made it necessary to devise an act the details of which would approximate, as closely as possible, the details of a real criminal action. Such an act having been formulated by the operator, another person selected several subjects and carefully instructed them in the method of performing the act. The operator then tested all the subjects concerned in the experiment and from the results obtained with each individual subject passed a judgment as to the guilt or innocence of that subject.

No attempt was made to evaluate the data secured in these

criminal association tests according to the "frequency tables" method. The operator, in forming his judgment, made use of the same criteria that were employed by Jung.¹ However, the method here employed was a refinement of the Jung method in one respect. It was decided that a much more accurate indication of guilt or innocence could be obtained if a subject's reaction time to a stimulus of the supposed guilty type were compared with the average reaction time of that subject to words of the same verbal form as the stimulus in question, than if this reaction time were compared with the subject's general average reaction time to stimuli of all the various verbal forms. This decision was justified by the fact that the results obtained in the first series of our experiments not only confirmed, but emphasized the results already obtained by earlier investigators, showing that there is a variation in the length of reaction time dependent upon the verbal form of the stimulus.

It had been hoped that the various tests that had been used in the first series of the experiment for the purpose of determining the possibility of influencing reactions and reaction times would result in a body of data that would make the association test a more delicate diagnostic mechanism. However, such a body of data was not obtained. Preceding definite verbal forms were found to have practically no influence upon the nature of the reaction to following ambiguous verbal forms. The influence of a statement of a given situation upon the reaction to an immediately following stimulus was found to be considerable. Yet this fact is unimportant as an aid in the determination of the presence of guilty knowledge when it is considered in connection with the lack of uniformity in length of reaction time which accompanies these cases. Even with the cases of successful influence of the preceding condition there were as many instances in which the reaction time was greater than, as there were instances in which it was less than, the general average reaction time. Moreover, with the cases in which the influence was unsuccessful there were many instances of markedly lengthened reaction time. Therefore, if one were attempting to test a

¹ See Introduction, page 7.

suspect by such a method and did actually obtain a much longer reaction time in the case of an unsuccessful influence of a stated *guilty* preceding condition it could be considered as evidence of neither guilt nor innocence. It would be impossible to determine whether the lengthened reaction time were the result of an inhibition caused by the arousal of an emotional complex, or the result of an inhibition caused by the arousal of a non-assimilating complex.

A general criticism that may well be made of the so-called criminal tests carried on in other laboratories is this; the man making the test was given three or four subjects to determine which one of this number was guilty. It was an easy matter from a comparative study of the results of these tests to pick out this one. I feel perfectly confident that with an observer of only average astuteness, under such conditions, failure is well nigh impossible. But such conditions as these are seldom found in the world of actual crime. There one is confronted with one or more subjects and the question is no longer "*which* is the guilty man," but rather, "are *any* of these guilty?"

In our tests we attempted to make the conditions as near an approach to reality as possible. To this end each person in the criminal series was tested as an individual and isolated case. A decision as to his guilt or innocence was reached before the next case was passed upon.

Also in carrying out the details of the pseudo criminal action every effort was made to cause the action to have the influence of a real crime upon the individual. With the real criminal, either through the emotional excitement or as the result of his careful and conscious planning, the details of the crime are almost indelibly impressed upon his memory. Almost always, also, the first of these causes works, because excitement, due to some hitch in the carrying out of his plans, some sudden surprise, or fear is present during the period of the commitment of the crime. The criminal, moreover, has a decided motive to keep the knowledge of his guilt to himself. This motive is intense because it means liberty, happiness, or even life itself.

While it was realized that it would be impossible to bring in

all these factors in a merely pseudo crime, in a degree even approximating their normal strength, yet we tried to make each as active a force as possible. To secure impression of detail on the mind of the subject, as definite instructions as possible were given in typewritten letters. Moreover, every detail of the action was worked out with one end in view—that of leaving definite impression. The element of surprise was effectively brought in by making it impossible for the subject to fulfill all the instructions, which failure left him in a rather unpleasant situation. The motive for concealment was present in a slight degree for nearly all the subjects who were put through the act entered heartily into the spirit of the test. They looked upon the whole thing as a sort of game at which they were trying to beat the operator. This spirit of the game was further increased by the offering of a slight reward to any subject who could conceal from the operator the fact that he committed the act.

The details of the pseudo criminal act were planned by the operator. The people² who were to act as criminals were selected from the list of subjects by Dr. Shepard of the Psychology Department. By him they were given a letter of instruction similar to the following:

You have been selected to act as the criminal for group number 1. Please be particular to follow these instructions and those that you receive later on, with as great an amount of exactness as possible. Put yourself in the position of a criminal who is prowling around to get whatever he may find.

Enter the psychology lab. from the North entrance—just as the library clock is striking the hour of 9 on the evening of March 26th (Tuesday). Proceed into the amphitheatre. On the table you will find a letter of further instructions. Follow these instructions carefully. Take particular notice of all the details about the table and the room. It is necessary that you be out of the building by 9.45; this, however, will give you plenty of time.

It is necessary to the success of the experiment that you keep as quiet as possible and be careful not to show too much light as you might attract the attention of passers by, or of the campus night-watch.

In the building the keys had been removed from the electric light switches. On a table in the amphitheatre, upon a white

² While a number of people went through the act, only one went through at any one time.

towel, were placed two fried cakes, a bottle of Puritan grape juice, a box with two Melachrino cigarettes. There were also on the table a lighted candle in a candlestick, some sulphur matches in a box, three pennies, a Prince Albert tobacco can, a picture of three dancing girls, which was wrapped in a piece of red tissue paper, two books—"Defrauding the Government," and "The Case of Dr. Horace."—, and the following letter of instructions:

March 26, 1912,

Letter of Instructions:

Select from the books on the table the one entitled "The Case of Dr. Horace." Note the name of the author and then turn to pages 116, 117, and 118,* and read them carefully.

Eat anything that you may find to eat. After this, smoke a cigarette, noting the brand. Then carefully investigate the contents of the table, taking anything that may seem of value to you and hiding it somewhere in the amphitheatre. If you do not wish to find yourself in an extremely embarrassing situation you will find it advisable to be out of the building at 9.45.* * But at any rate take plenty of time to follow these directions carefully and thoroughly.

If you do follow these directions carefully, and can prevent the examiner from finding out that you are the guilty party, you will receive as a reward a box of candy (Martha Washington Candy) or, at your option, fifty cents worth of OWL cigars, or two boxes of Philip Morris cigarettes.

* The book "The Case of Dr. Horace," was a detective story, and the particular pages here given to be read were selected because of their local coloring. They described events taking place between Ann Arbor and Jackson. It was thought that this would impress the name of the book upon the subject.

** Once the subject was inside the amphitheatre the outside door was carefully and quietly fastened from the outside; the windows had already been nailed from the outside. Thus the subject was taken by surprise when he attempted to leave the building. Practically all the subjects forced the windows.

Of the subjects tested there were several of the innocent ones who unwittingly gave away this fact by their attitude or remarks. These cases, and some others were considered worthless. I have selected for presentation here three cases that are typical of quite different sorts of results. After each case given, the conclusions of the operator, together with the basis for the same, and the actual facts as to the guilt or innocence of the subject tested will be given. The words that were inserted because of

their connection with the details of the act are marked with the asterisk. The numbers in parentheses are the subject's average reaction times for that particular form of reaction, noun—noun, noun—adjective, etcetera. Words or reaction times marked @ are those which the operator considered as giving evidence of guilt. The last column of figures gives the reaction times for the repeated series.

CORRECT JUDGMENT OF GUILTY

Case No. 24

1. Coat	_____	_____	_____	_____
2. Bitten	Sweet	1.136		1.286
3. Cream	Butter	1.280		.906
4. Peaches &	Cream	_____		.869
5. Wall	Paper	.870		.743
6. Smoke*	Tobacco	(1.038) 1.334 @	Good @	.865
7. Philip*	Holmes	1.072	I @	.777
8. Winsome	Smile	.968		.940
9. Dish	Water	.780		.812
10. Foot	Sore	.954		.933
11. { Paper*	Wall	(1.100) 1.464 @	Paper @	.777
12. { Tissue*	Paper	(.741) 1.521 @	Good @	1.289 @
13. Pipe	Smoke	1.255		_____
14. { Albert*	Edward	1.386	Prince @	1.171
15. } Prince*	Albert	(.741) 1.269 @	Wales @	1.435
16. Quiet	Room	(.786) 1.444 @	Smoke @	1.112 @
17. Dinner	Party	1.321		1.007
18. Rain	Drop	1.088	Coat	.977
19. Bull	Red	1.815		1.095
20. Ink	Ink	.940	New	.662
21. Book*	Desk	(.912) 1.389 @	High @	.978
22. Case of*	Books	1.113		.786
23. Doctor*	Bush	1.391	Good @	.772
24. Meek	Smile	(.786) 1.059 @	Old @	.522
25. Poet	Laureate	1.076		.873
26. Block	Wood	1.076	White	.795
27. Sing	Song	.932		.832
28. Ginger	Bread	.881		.790
29. Flower	Bed	.885		.812
30. Bottle*	Ink	.963		1.061
31. Grape*	Red	(1.100) 1.212		.634
32. Juice*	Blue @	(1.100) 1.152	Good @	.571
33. Oval	Window	.922		1.246 @
34. Knee	Sprung	1.209		.794
35. Vase	Church	.772		.877
36. Leather	White	.662		.784

37. { Clock*	High @	.685	New @	.794
38. } Library *	Clock	(.741) .925	Book @	1.383 @
39. Human	Mind	.990	Man	.765
40. Tin*	Box @	(.786) 1.360 @		.729
41. Cents*	Blue @	(1.100) .881 @	Man @	.736
42. Three*	Good @	.664	Bed @	.879
43. Life	High	.778	Bright	.986
44. Pencil	Short	.613	Blue	.561
45. Frog	Bright	.634	Leg	
46. Swamp				
47. Queen	White	.928	Elizabeth	.826
48. Apply	Apple	1.054		.755
49. Search	Me	1.257	Quick	.733
50. Expert				
51. Reward*	Me	(.880) 1.222 @	Buy @	.563
52. { Candy*	Cheap	(1.100) 1.078	Red	.842
53. } Box of*	Candy	(.795) 1.223 @		1.284
54. { Washington*	George	1.457		.468
55. } Martha*	Kusterer	1.273	Hyde	.371
56. Sly	Fox	(.786) 1.257 @		.826
57. { Cigars*	Cheap	1.057		.888
58. } Owl*	Cigars @	(.741) 1.722 @	Wise @	.601
59. Ancient	Old	.910		.789
60. Unexpected	Quick	1.114		1.037
61. Stove	Man	.659	Polish	.770
62. Oil	Good	1.601	Cheap	.926
63. Extreme	Boy	.610	Good	1.036
64. Modern	Boy	1.060	New	1.193
65. { Door*	Knob	.994		.566
66. } Locked*	Pain	.826	Door @	1.962 @
67. Escape*	Quick	(.983) 1.127	Pain	.819
68. Window*	Sash	(.912) 1.216 @		1.143
69. Climb*	Back	(.983) 1.418 @	Good @	
70. Pure	Food	.972		.795
71. Blind	Bat	1.285	Mice	.815
72. Book*	Blue	.732	New	.971
73. Hide*	Seek	1.047	High	.870
74. Bone	Ash	1.134		
75. Sharp	Eyes			.712
76. { Stick*	Pin	.919		.607
77. } Candle*	High	.732	Good	
78. Grind	Quick	.932	Man	
79. Play	Good	1.616	White	.904

A judgment of guilty was correctly made in this case. The grounds for this judgment may readily be seen by referring to the words and times marked @ in the preceding list. The main grounds may be summarized as follows:

1. Lengthened reaction times in the case of the guiltily associated stimuli numbers 6, 11, 12, 14, 21, 40, 51, 53, 58, 68 and 69; and in the reaction times to stimuli numbers 16, 24, and 56 which immediately followed words with guilty associations.

2. The shortened reaction time for stimulus No. 41, taken in connection with the nonsense reaction "blue."

3. The lengthened reaction time for stimuli numbers 15, 38, 53, and 65, and 34 (immediately following a changed response to a guilty test word) in the repetition series.

4. The fact that 73 per cent of the responses to the words of supposedly guilty association tendencies were changed in the repetition series, while only 39 per cent of the responses to all the other stimuli were changed.

5. Nonsense character of reaction words to stimuli 41 and 42 in both the original and the repetition series.

6. The peculiarly suggestive character of the reaction word in a number of cases. (1) In the second series, immediately after the stimuli Prince and Albert, the response Smoke was given to the stimulus Quiet. This indicated that the Prince Albert tobacco combination had been called up, even though the response to Prince had been Wales. This is particularly suggestive owing to the fact that the reaction time for Prince—Wales was greater than the reaction time for Prince—Albert in the first series. (2) The response "Blue" to the stimulus Juice (as the grape juice was blue). Response changed to "Good" in the repetition series. (3) The response "High" to the stimulus Clock (the library clock is high). Response changed to "New" in the repetition series. (4) The response "Box" to the stimulus Tin, especially with the accompanying marked retardation in the reaction time.

The two bits of evidence that were most convincing were the reaction "Owl" for the stimulus Cigars with the accompanying great increase of reaction time and the change of the response to "Wise" in the repetition series, and the response "Door" to the stimulus Locked in the repetition series, together with the great lengthening of the reaction time.

The introspections of this subject were as follows: "The

method used to conceal guilt was to think out before the test words to associate with words that I thought would be most likely used to detect me. In addition to this I tried to have in mind some noun or adjective that would go with most anything, and use this if the word exposed were incriminating. All that I knew about the test was that it was something like the first association test.

"The words which had a guilty association at first were as follows: Philip, Doctor, Grape, Juice, Cents, Three, Candy, Washington, Martha, Door, Locked, Window, Candle. The ones which called up a guilty association after the response were: Smoke, Case of, Library, Owl, Climb, Book, and Escape.

"I was conscious a few times of delay when a word of the 'guilty' type appeared before giving the word. The feeling of guilt acted as an inhibition to making any association, and if the word given in reply were incriminating I would be painfully conscious of the fact. In the second test I was able to remember where I had made some guilty associations and use new words. These new words were prepared before hand and kept in readiness. In some places I was able to shorten time reactions which would indicate guilt where the words given did not. With some words of the 'guilty' type I got associated words which I had not prepared beforehand and which were not associated with the 'crime,' as, for example, Doctor, Stick, Case of, Pencil and Book.

INCORRECT JUDGMENT OF GUILTY

The conditions in this test case were practically the same as in the other. A newspaper was added to the items on the table; a box of Zuzu ginger snaps was also added; a comic picture of several musicians gazing after a passing girl and entitled "A Rubber Band" was inserted in the book at the pages which the subject was instructed to read.

Case No. 30.

1. Coat	None	2.381		.798
2. Bitter	Sweet	1.229		1.348
3. Cream	Ice	1.351	Sweater	.189

4. Peaches &	Cream		1.270		.604
5. Wall	Street		.760		.568
6. Smoke*	Fire	(1.156)	1.192		1.059
7. Philip*	Man		2.240 @	Wild	.639
8. Winsome	Lady		1.145		.646
9. Dish	Pan		.846		.583
10. Foot	Pad		.883		.621
11. { News*	Paper		.881		.703
12. { Paper*	Basket		1.095		.771
13. { Tissue*	Paper	(.821)	1.204 @		.513
14. Pipe	Smoke		1.866	Wrench	.249
15. Albert*	Marks		1.640	Prince	.893
16. Prince*	Albert	(.821)	1.545 @		.767
17. Quiet	Room		1.115		.788
18. Dinner	Pail		1.514		.506
19. Rain	Storm		1.384		.669
20. Bull	Durham		1.354		.568
21. Ink	Paper		1.714	Stand	.556
22. Book*	Wrack	(.925)	1.442 @	Mark	.564
23. Case of*	Slander		1.248		1.245
24. Doctor*	Jones		1.100	Bolz	.890
25. Meek	Person	(1.000)	1.915*	Lady	.553
26. Poet	Laureate		.897		.767
27. Sing	Song		.905		.507
28. Snap*	Shot		.618		.535
29. Ginger*	Ale		.645		.452
30. Flower	Pot	(1.000)	1.403 @		.648
31. Bottle*	Wine		.853		.654
32. { Grape*	Juice		1.156		.346
33. { Juice*	Grape	(1.101)	1.401 @		.525
34. Oval	Window		.857		.639
35. Knee	Trousers		1.712		.830
36. Vase	Circular		2.443	Flowers	.771
37. Clock*	Work	(.925)	1.107		.504
38. Library*	Table @	(.925)	3.054 @		.767
39. Human	Voice	(1.000)	1.324 @	Being	.564
40. Tin*	Pan	(.925)	1.412 @		.458
41. Cents*	Dollars	(1.156)	2.100 @		.733
42. Three*	Men	(1.000)	1.340 @	Cents @	1.937 @
43. Life	Saver	(.925)	1.842 @		
44. Pencil	Ruler	(1.156)	3.006 @	Sharpener	.720
45. Frog	Horn	(.925)	1.612 @		1.226
46. Swamp	Ground	(1.156)	3.500 @		.816
47. { Band*	Iron	(1.028)	2.133 @	Stand	.606
48. { Rubber*	Stamp		.934		.596
49. Queen	Wood	(1.156)	2.378 @		1.159
50. Expert	Cracksman		.981		.751
51. Reward*	Offered		1.189		.586

52.	{ Candy*	Kid	(.925)	1.222		.665
53.	{ Box of*	Tools	(.982)	2.431 @	Candy	.446
54.	{ Washington*	George		1.882 @	Birthday	1.229
55.	{ Martha*	Washington	(.821)	1.771 @		.408
56.	Sly	Man		.792		.580
57.	Cigars*	Stubs		1.050	Brand	.957
58.	Owl*	Brand @		1.070		.341
59.	Ancient	Mariner		1.265		.578
60.	Unexpected	Visitor		.835		.555
61.	Stove	Pipe		1.527		.570
62.	Oil	Machine		1.588	Stove	.601
63.	Extreme	Case		.872		.633
64.	Modern	Improvements		1.582		.471
65.	Locked*	In @	(1.020)	.647 @		.506
66.	Door*	Lock @		.977	Key	.732
67.	Escape*	Uninjured		1.330		1.031
68.	Window*	Lock @	(1.743)	1.692		.497
69.	Climb*	Out @	(1.653)	.717 @		.571
70.	Pure	Butter	(1.000)	1.420 @		1.229
71.	Blind	Man		.700		.618
72.	Book*	Mark		.739		.506
73.	Hide*	Quick	(1.743)	1.410	Seek	.577
74.	Bone	Head		.865		.632
75.	Sharp	Shooter		.809	Wit	1.183
76.	Stick*	Fast	(1.743)	1.790	Pin	.973
77.	Candle*	Fire	(1.156)	2.167 @	Stick	.788
78.	Grind	Stone		.790	Organ	.624

In this case the examiner felt from the evidence at hand that there was no doubt that he had discovered a guilty subject. This judgment was based on the following facts:

1. Lengthened reaction times in the case of the supposedly guiltily associated stimuli, numbers 13, 16, 22, 33, 38 (especially), 40, 41, 42, 47, 53, 54, 55, and 78; for lengthened reaction times in the case of words following the guilty stimuli in numbers 25, 30, 39, 49, and the series 43, 44, 45, 46. The consistent and very decided retardation in these last four cases, which immediately followed the group of three guilty stimuli 40, 41, and 42 gives the strongest kind of evidence of the inhibition resulting from the association trains aroused by the guilty stimuli.

2. Marked lengthening of reaction time to stimulus 42 in the repetition series. (The fact that there was in the repetition series a 34 per cent change in the responses to the guilty stimuli

as opposed to a 24 per cent change in the responses to the non-guilty stimuli was not considered as a strong enough difference to be evidence of guilt.)

3. Suggestions in the nature of the responses themselves: (1) Pair 38-39. For this subject on the preliminary test this indirect form of influence worked in 60 per cent of the cases. The fact that in this case it did not work, together with the fact of the extreme retardation give strong indication of guilty inhibition. (2) Response "Brand" to the stimulus Owl, with a fairly short reaction time. (3) The response "In" to the stimulus Locked, and of "Out" to the stimulus Climb, especially when considered in connection with the very marked decrease in the reaction time, and this being followed—in the latter case—by a retardation in the reaction to the immediately following innocent stimulus seem to clearly indicate the inadvertent guilty reaction. (4) The response of "Lock" to both the stimulus Door and the stimulus Window.

The evidence in this case is certainly as conclusive as in the preceding case, and yet the person tested was not guilty and knew absolutely nothing about the details of the act.

INCORRECT JUDGMENT OF INNOCENT

Case No. 29.

1. Coat	Hat	1.899		.542
2. Bitter	Sweet	.791		.585
3. Cream	Ice	.946	Cheese	.661
4. Peaches &	Cream	.750		.882
5. Wall	Street	.732		.585
6. Smoke*	It	(1.153) 1.072		.841
7. Philip*	Smoke @	1.136	Read @	1.143
8. Winsome	Lass	(1.122) .899		.746
9. Dish	It	.740		.586
10. Foot	It	.597		.658
11. { News*	Item	(1.025) 1.168		.671
12. { Paper*	News	(1.216) .857		.971
13. { Tissue*	Paper	(.821) .735		.571
14. Pipe	It	.893		.609
15. { Albert*	Come	1.556	Prentiss	.999
16. { Prince*	Piper	(1.184) 1.138	Albert	1.160
17. Quiet	Hour	(1.122) 1.110		.626
18. Dinner	Time	1.086		.735

19. Rain	Shower		.865		.771
20. Bull	Run		.850		.658
21. Ink	Well		1.055		.571
22. {Book*	Time	(1.184)	1.290	Look	.674
23. }Case of*	Me		.795	It	.950
24. Doctor*	Hyde		1.080	He	1.821 @
25. Meek	Me	(1.286)	.787		.589
26. Poet	Keats		.808		.749
27. Sing	Song		1.195		.844
28. {Snap*	Shot		.749		.726
29. }Ginger*	Ale	(1.025)	.836		.683
30. Flower	Pot		.762		.558
31. Bottle*	Of ale		.867	Of wine	.970
32. Grape*	Juice	(1.025)	.867		.599
33. Juice*	It	(2.469)	.845		.773
34. Oval	Glass	(1.122)	1.094		.782
35. Knee	Cap		.847		.707
36. Vase	Of flowers		.574		.610
37. {Clock*	Time	(1.184)	.659		.811
38. }Library*	Clock	(.821)	.519		.599
39. Human	Face	(1.122)	.524		.529
40. Tin*	Kid	(1.025)	.587	Face	.533
41. Cents*	Two	(1.390)	.974		.797
42. Three*	Cents	(1.122)	.591		.710
43. Life	Mother	(1.184)	.560	Clock	1.425 @
44. Pencil	Mother		.615	Case	.747
45. Frog	Jump		.845		.645
46. Swamp	Root		.819		.596
47. {Band*	Top	(1.025)	1.217 @	Clock	.770
48. }Rubber*	Face	(1.025)	1.197	Neck	.698
49. Queen	Sheba		.716		.644
50. Expert	Dentist		.630		.994
51. Reward*	Merit	(1.406)	.738		.635
52. {Candy*	Top	(1.025)	.883	Fay	.862
53. }Box of*	Fay		.492	Candy	.564
54. {Washington*	Irving		.374		.663
55. }Martha*	Washington	(.821)	.638		.354
56. Sly	Watch		.528	Peek	.854
57. {Cigars*	Box	(1.025)	.944		.865
58. }Owl*	Face	(1.025)	.758	Look	.767
59. Ancient	Mariner	(1.112)	.665		.567
60. Unexpected	Escape		.897		.591
61. Stove	Pipe		.925		.627
62. Oil	Stove		.729		.642
63. Extreme	Difficulty		.961		.884
64. Modern	Fiction				.637
65. Locked*	Door @	(1.122)	.867		.520
66. Door*	Man		.778	Locked	.580

67. Escape*	Through the Door @	.958	Hard @	.981
68. Window*	Pain (1.025)	1.030		.587
69. Climb*	High (1.118)	.848	Hard	.981
70. Pure	Water (1.122)	.609		.532
71. Blind	Man	.683		.743
72. Book*	Door @ (1.184)	.659	Look	.766
73. Hide*	It (1.153)	.705	Seek	.951
74. Bone	It	.790		.719
75. Sharp	Look	.780		.797
76. {Stick*	To it (1.440)	.651		.664
77. {Candle*	Home (1.184)	.846	Light	.650
78. Grind	Hard	.843		.589
79. Play	Quick	.513	Hard	—

In these results there were only slight indications pointing to any guilty knowledge on the part of the subject tested. These indications were:

1. The response "Smoke" to the stimulus Philip, with the change in response in the second series, together with a slightly long time with both reactions.

2. The response "Door" to the stimulus Locked; of "Through the door" to the stimulus Escape, together with—in the latter case—the change to the response "Hard" in the second series.

3. In the second series the lengthened reaction time to No. 43, which immediately follows a guilty stimulus.

4. The fact that 50 per cent of the responses to the guilty words were changed in the repetition series, while only 12 per cent of the responses to the non-guilty stimuli were so changed.

But all these indications were very slight. Other facts that seemed very much more strongly to indicate the innocence of the subject were:

1. Of the thirty guilty association words the reactions to which corresponded to reactions in the first association experiment upon this subject, the reaction times were shorter in 25 cases, than the normative averages established in that series. The remaining five reaction times were but very slightly longer—never more than .2 of a second. The reaction times in those cases where no comparison was possible were all of moderate length.

2. In no case was the reaction time for a stimulus immediately following a guilty stimulus longer than the normal, with the exception of No. 43 of the repetition series.

3. The few cases of apparently meaningless pronoun reaction as Case of—Me, and Doctor—He, could hardly be considered as evidence of guilt, for such reactions were quite common in the earlier test series of this subject.

On the basis of these facts the balance of evidence seemed to be clearly in favor of the innocence of the subject, and accordingly such a judgment was passed by the examiner. Yet this judgment was wrong. The following introspections show how fully this subject had entered into the spirit of the action and the succeeding test:

"I had a method which I thought I could carry through, but was unable to on account of physical and mental conditions with which the crime had nothing to do. I did not try to think of new or innocent associations for the 'guilty' words, but wanted to depend upon a different attitude. In the previous test a certain experience constantly appeared, together with a homesick feeling, which gave the associations. I intended to revive this experience and this feeling, that is, maintain a certain mental attitude unconnected with the crime. I am able to choose my mental attitude to a very great extent, and can place myself vividly in any known place with ease. Had my brain been in its usual state (or normal rather) I could have succeeded to a greater extent, I'm sure.

"I've read everything on this test that came within my reach and always longed to try it. Had *great faith* in its infallibility.

The guilty words were Philip, paper, Albert, Prince, book, case of, doctor, bottle, grape, juice, clock, two cents, candy, Martha, unexpected, extreme, modern, window, bone, and candle. The second time there was little guilty feeling. I had the sensation of having confessed. I knew that it was all up with me long before that, and so the responses were more or less automatic memory responses. In cases where I tried to conceal the first time, I gave the original response (with no guilty feeling, however).

"I had a feeling of being accused—of being guilty—of the accuser's sure knowledge of my guilt, and a great fear. My partner knew of my guilt and that bothered me, too. I had

been sleeping very poorly for some time before being asked to act as a criminal. I thought that the crime made little impression on me. I enjoyed it all very much. Was not a bit frightened, not even when I found the door locked. During the day of my test, however, I had several great nervous strains, and had no chance to take the rest I had planned in order to calm my thoughts. Had a headache, was extremely weary, nervously and mentally fatigued.

"I kept thinking as I saw that I was giving myself away—'Won't get the candy.' After the response 'Escape through the door' came, I didn't try any more to disguise—knew I wasn't acting at ease, which made me feel all the worse.

The above introspection was written by the subject immediately after the test was made. Some days afterward when she was told that she had been judged innocent she gave the following additional introspection:

"I am so surprised at the outcome of the test that I wish to add to what has already been said.

"When I went to commit the crime I felt very criminal. I wore a black scarf over my head, that could easily be drawn over my face. I went by dark and unfrequented streets trying to avoid being seen. I had to pass a lighted store and saw some men coming on the other side. I tried to avoid meeting them and turned my head as I passed them. It was not put on, I just felt like a sneak. When I started I thought it might be well to wear rubbers so that I could go more quietly, but finding the silent tread more noticeable than the common step, I took them off. I carried them for a ways, then thought that they would be in my way. I tried to find a place to hide them, and finally carried them back a block and hid them behind an oak tree.

"As I entered the building I felt bold, determined, and wicked,—ready to do anything. The sight of the bottle and cigarettes pleased me and I thought of 'dime novels.' I had always wanted to see what smoking felt like, but had never had such a good excuse—besides, if I really smoked it, that would add to my sense of guilt. The flickering candle lent a

most 'robber's den' atmosphere to the scene. I was so anxious to try to smoke that I ate only one or two Zuzus before lighting the cigarette. (I had noiseless matches in my pocket.) I proceeded to smoke and to read the books and paper between puffs, enjoying both very much. Then I tried to open the bottle and was sorry I couldn't.

"When about to leave the room I filled my pockets with Zuzus, thinking 'I'm going to get all there is in it, anyway!'—(I like Zuzus) I was glad that I did when I found the door locked, for I had something to eat.

"From this it can be seen that the crime had every chance to make a strong impression upon me, as a crime. Indeed, I felt very guilty, I felt as though I had done something very wrong and this feeling did not pass away until the following Monday noon. (The crime was committed upon Thursday night.) The smoking had been a real crime and the guilt was real, it felt like the real thing!"

As was stated in the introduction, in the undertaking of this series of experiments I had a strong tendency to believe in the efficacy of the association test for the purpose of determining the presence or absence of knowledge of a crime on the part of the subject tested. In attempting to work out a more dependable system by which the results of the tests could be judged, the part of the work that was originally intended to be merely subsidiary came to occupy the position of chief importance, and I feel now, in closing this discussion, that if any contribution has been made to the psychology of association, it has been in the throwing of further light upon the general nature of the association process and the causes of the variation in the length of association reaction times, rather than in any contribution looking toward a practical use of the method.

As to the possibility of such a practical use our results have been entirely negative. These results show clearly that it is possible to make a much finer measurement of the lengthening of reaction times, than has hitherto been made. But they show further, that even with this added refinement, the method can-

not be depended upon as a means of determining guilty knowledge. With certain naïve types, as in the first case given above, it might work. However, the fact that the results pointed so conclusively in one case to the guilt of an absolutely innocent test person, while in the case of the one person who entered most thoroughly into the spirit of the test no positive evidence was obtained, makes it impossible, on the basis of our present knowledge to depend upon this test.

TABLE A. 1-22*

#1.	N.	V.	M.	#5.	N.	V.	M.
Nouns	18 1.396	13 1.342	39 1.151	Nouns	17 1.011	32 .909	48 .806
Pron.		3 .799		Pron.			
Prop.	3 1.006			Prop.			
Adj.	4 1.012	5 1.463	7 1.035	Adj.	7 .868	3 1.002	1 .568
Past. A.		13 .757		Past. A.		13 .887	
Verbs		8 1.287		Verbs		2 1.097	
Exclam.	1 1.417			Total	24 .969	50 .916	49 .800
Phrase	1 .941	3 1.040	1 .965	Unusable	4		1
Unclass.		3 1.432	2 .585	N.as Adj.	12 .864		
Total	27 1.280	48 1.140	49 1.108	Abst. N.	10 1.262		
Unusable	2	2	1	Gen. Av.	123 .881		
N.as Adj.	11 1.006						
Abst. N.	10 1.518			#7	N.	V.	M.
Gen. Av.	124 1.157			Nouns	15 1.662	13 2.006	37 1.035
#2.	N.	V.	M.	Pron.		19 1.344	1 2.169
Nouns	22 2.688	10 2.253	19 1.948	Prop.	2 1.667	1 .958	1 .732
Prop.		1 3.248		Adj.	5 1.311	6 1.253	7 1.101
Adj.	9 1.749	3 2.019	31 1.629	Verbs	1 .924	4 1.475	2 1.071
Verbs	1 2.309	35 1.784		Inter.		3 2.162	2 3.411
Prop.		1 2.165		Exclam.	2 1.077		
Total	32 2.413	50 1.929	60 1.750	Prep.		1 1.027	
Unusable	2			Unclass.	2 1.114		
N.as Adj.	6 1.751			Total	27 2.189	46 1.569	50 1.157
Abst. N.	10 2.490			Unusable	1	4	
Gen. Av.	138 1.969			N.as Adj.	12 .979		
#3.	N.	V.	M.	#8	N.	V.	M.
Nouns	21 1.513	7 1.598	29 1.403	Nouns	15 1.203	11 1.471	44 1.326
Pron.		33 1.280	7 1.248	Pron.	1 .919	26 .985	1 1.561
Prop.				Prop.	2 1.106		
Adj.	6 1.030	4 2.064	11 1.316	Adj.	7 1.206	6 1.032	3 1.165
Verbs		1 2.557	1 1.197	Verbs	2 1.116	1 1.497	
Inter.		1 5.086		Prep.	2 1.146	5 1.161	2 1.240
Exclam.	2 1.264	2 1.893	2 1.299	Total	29 1.178	49 1.152	50 1.318
Phrase		2 3.448		Unusable		1	
No React.				N.as Adj.	11 .963		
Total	29 1.596	49 1.594	50 1.354	Abst. N.	10 1.180		
Unusable	1	1		Gen. Av.	139 1.194		
N.as Adj.	11 1.324			#9	N.	V.	M.
Abst. N.	10 1.587			Nouns	9 2.110	15 2.707	27 2.328
Gen. Av.	126 1.479			Pron.		3 2.499	
#4.	N.	V.	M.	Prop.	5 2.013	3 2.027	2 2.354
Nouns	11 1.305	17 1.243	36 1.059	Adj.	8 1.949	3 2.525	16 2.374
Pron.		8 .812	1 .635	Verbs		3 2.689	
Prop.	2 1.442		1 .758	Phrase	5 1.575	12 2.195	1 7.200
Adj.	7 1.145	8 .985	5 .991	Unclass.	1 1.802	5 2.837	1 2.016
Verbs	3 1.229	1 .905		No React.	5 1.879	3 2.420	
Inter.	2 1.021	15 1.306	7 1.103	Total	35 1.930	47 2.502	47 2.485
Prep.		1 .708		Unusable	1	2	
Unclass.	2 .973			N.as Adj.	6 1.993		
Total	27 1.219	50 1.134	50 1.043	Abst. N.	10 3.070		
Unusable				Gen. Av.	127 2.347		
N.as Adj.	13 1.129						
Abst. N.	10 3.281						
Gen. Av.	127 1.117						

#5 and #18 omitted, because incomplete.

#10.	N.		V.		M.		#14.	N.		V.		M.	
Nouns	13	1.637	38	2.583	45	2.097	Nouns	10	3.004	25	3.628	36	2.446
Pron.			7	2.037			Pron.			9	3.206		
Prop.	10	1.988	6	1.815	2	1.654	Prop.			2	1.678		
Adj.	13	1.646	4	1.339	1	4.772	Adj.	7	2.498	2	3.454	3	2.020
Verbs	1	.527	1	2.957			Verbs	3	2.102	2	3.194	1	3.584
Unclass.			1	2.958			Unclass.	3	1.410	9	3.156	7	4.494
Total	37	1.775	47	2.305	48	2.134	Total	23	2.554	49	3.360	47	2.961
Unusable			3		2		Unusable	1		1		3	
N.as Adj.	3	1.958					N.as Adj.	16	1.836				
Abst. N.	10	2.673					Abst. N.	10	3.741				
Gen. Av.	132	2.094					Gen. Av.	119	3.047				

#11.	N.		V.		M.		#15.	N.		V.		M.	
Nouns	18	1.920	35	2.735	40	2.274	Nouns	28	1.855	31	1.906	32	1.598
Pron.			4	1.464	1	1.909	Pron.			8	1.643		
Prop.	2	2.216					Adj.	4	.955	6	1.329	9	1.870
Adj.	6	1.998	2	1.241	4	1.561	Verbs	1	1.274	1	1.951	2	3.277
Verbs	2	1.742	2	3.260			Prep.			2	2.092		
Prep.			1	1.193			Total	33	1.474	48	1.799	49	1.737
Unclass.	1	2.485			1	1.946	Unusable			2		1	
No React.	2	4.866	4	7.460	1	17.033	N.as Adj.	7	1.689				
Total	31	2,151	49	2.951	47	2.515	Abat. N.	10	2.485				
Unusable	1				3		Gen. Av.	130	1.654				
N.as Adj.	8	1.566											
Abat. N.	10	4.601											
Gen. Av.	126	2.591											

#12.	N.	V.	M.	#16.	N.	V.	M.
Nouns	20 1.651	21 1.697	34 1.359	Nouns	22 1.229	25 1.244	40 1.039
Pron.		2 1.861		Pron.		16 1.023	5 1.099
Prop.		2 .878		Prop.	1 1.816		
Adj.	3 1.266		4 1.201	Adj.	5 1.262	6 .766	2 1.560
Verbs		8 1.355	1 1.998	Verbs	3 1.054		2 1.018
Exclam.	2 1.297			Phrase	1 .913		
Phrase	5 1.255	12 1.434	10 1.561				
No React.	1 1.705	1 5.043		Total	52 1.197	47 1.108	49 1.089
	—	—	—	Unusable	2	3	1
Total	31 1.529	46 1.572	49 1.398	N.as Adj.	6 .987		
Unusable	1	4	1	Abst. N.	10 1.079		
N. as Adj.	8 1.266			Gen. Ave.	134 1.124		
Abst. N.	10 2.065						
Gen. Av.	126 1.494						

Gen. Av. 127 1.261				#17.	N.		V.		M.				
#13.	N.		V.		M.		Nouns	23	2.642	23	2.485	21	2.054
Nouns	12	1.470	23	1.466	42	1.077	Pron.			3	2.170		
Pron.			7	.956			Prop.	2	1.288	2	7.713	6	3.670
Prop.	3	1.713	2	2.486			Adj.	4	1.771	3	1.872	21	2.096
Adj.	7	1.157	9	1.132	2	.724	Verbs			15	2.067		
Verbs	3	1.115					Phrase	1	3.015	3	2.876		
Phrase	2	1.019	6	2.276	1	.884	Unclass.			1	1.603		
Unclass.	3	2.386					Total	30	2.448	50	2.507	48	2.274
							Unusable					2	
Total	30	1.447	47	1.471	45	1.057	N.as Adj.	10	1.299				
Unusable	1		3		6		Abstr. N.	9	3.168				
N.as Adj.	9	.985					Gen. Av.	128	2.406				
Abstr. N.	10	1.722											
Gen. Av.	127	1.261											

#19.	N.			V.			M.		
Nouns	19	1.002	39	1.230	50	1.005			
Pron.									
Prop.	1	.848							
Adj.	1	1.035	4	1.108					
Verbs	3	1.334	1	1.341					
Unclass.			1	1.308					
Total	24	1.039	45	1.224	50	1.005			
Unusable	1		5						
N.as Adj.	15	1.008							
Abst. N.	7	1.510							
Gen. Av.	119	1.094							

#20.	N.			V.			M.		
Nouns	36	1.275	7	1.839	9	1.648			
Adj.	2	1.046	3	2.000	39	1.410			
Verbs	1	1.273	39	1.617	1	1.149			
Total	39	1.264	49	1.672	49	1.489			
Unusable			1		1				
N.as Adj.	1	.955							
Abst. N.	9	1.963							
Gen. Av.	137	1.490							

#21.	N.			V.			M.		
Nouns	21	1.002	27	1.139	37	.850			
Pron.			1	.739	1	1.455			
Prop.	1	.950							
Adj.	2	1.259	3	.957	8	.753			
Verbs	1	.850	8	.881	2	.923			
No React									
Partic.	1	.929	1	1.750					
Unclass.			2	1.011					
			1	1.300					
Total	26	1.011	43	1.081	48	.850			
Unusable	3		7		2				
N.as Adj.	11	.888							
Abst. N.	10	1.362							
Gen. Av.	117	.971							

#22.	N.			V.			M.		
Nouns	11	1.096	20	1.679	46	.981			
Pron.									
Prop.	4	1.550	20	1.188	1	2.089			
Adj.	8	1.128	6	.938					
Verbs	6	1.100	1	1.787	3	1.537			
Total	29	1.140	47	1.378	50	1.039			
Unusable			3						
N.as Adj.	11	.932							
Abst. N.	10	1.551							
Gen. av.	126	1.189							

#23.	N.			V.			M.		
Nouns	20	1.326	12	1.127	35	.879			
Pron.	1	.921	14	.935					
Adj.	2	.826	17	1.125	11	1.034			
Verbs	1	1.662							
Exclam.	3	1.189							
Phrase	3	1.267	5	1.095	4	1.183			
No React.			2	1.618					
Total	30	1.270	50	1.109	50	.938			
N.as Adj.	10	.944							
Abst. N.	10	1.452							
Gen. Av.	130	1.080							

#24.	N.			V.			M.		
Nouns	12	.912	12	1.038	41	.786			
Pron.			23	.880	3	.896			
Prop.			1	1.070					
Adj.	8	1.100	13	.983	4	.703			
Verbs	1	1.121	1	.803					
Unclass.	1	.777							
Total	22	.983	50	.947	48	.786			
Unusable	1				2				
N.as Adj.	17	.840							
Abst. N.	10	1.104							
Gen. Av.	120	.889							

#25.	N.			V.			M.		
Nouns	10	.856	24	.843	39	.749			
Pron.			9	.663					
Prop.	2	.517	1	.877					
Adj.	1	.670	9	.802	4	.757			
Verbs	12	.744							
Unclass.			1	1.143					
Completions			5	.565	6	.685			
No React.			1	.905	1	1.217			
Total	24	.777	50	.783	50	.752			
N.as Adj.	16	.795							
Abst. N.	10	.896							
Gen. Av.	124	.769							

#26.	N.			V.			M.		
Nouns	24	1.627	19	1.945	23	1.651			
Pron.			9	1.561					
Prop.	1	2.746							
Adj.	3	1.390	3	1.473	14	1.561			
Verbs	3	1.437	15	2.674					
Unclass.	1	1.248			3	1.883			
Repetition	1	2.095	1	5.827					
Total	33	1.618	47	2.157	49	1.640			
Unusable	1		3		1				
N.as Adj.	6	1.520							
Abst. N.	10	2.066							
Gen. Ave.	129	1.978							

#27.	N.		V.		M.	
Nouns	20	1.048	7	1.362	17	.989
Pron.			10	.821		
Adj.	4	.997	3	1.251	30	.957
Verbs	6	1.082	28	1.057	1	.980
Phrase			1	1.452		
Total	30	1.048	49	1.073	48	.956
Unusable			1		2	
N. as Adj.	10	.830				
Abst. N.	10	1.092				
Gen. Av.	127	1.023				

#28.	N.		V.		M.	
Nouns	23	.658	12	1.043	17	1.048
Pron.			1	.928		
Adj.	3	.392	1	1.529	31	.809
Verbs	4	.692	23	.651	1	.835
Total	29	.635	37	.797	49	.893
Unusable	5		13		1	
N. as Adj.	6	.578				
Abst. N.	10	1.648				
Gen. Av.	115	.797				

#29.	N.		V.		M.	
Nouns	21	1.184	8	1.406	27	1.122
Pron.	1	2.469	13	1.153	4	1.286
Adj.	7	1.390	6	1.118	15	1.184
Verbs	4	1.533	17	1.474	2	2.141
Phrase			1	1.440		
Unclass.			1	2.473		
Total	33	1.309	46	1.346	48	1.197
Unusable			4		2	
N. as Adj.	7	1.025				
Abst. N.	10	1.851				
Gen. Av.	127	1.280				

#30.	N.		V.		M.	
Nouns	10	1.156	26	1.079	45	1.000
Pron.			8	.788		
Prop.	1	1.434				
Adj.	6	1.028	12	1.653	1	1.020
Verbs	1	1.743			1	1.330
Comple'tns	2	1.065	3	1.787		
Total	20	1.172	49	1.213	47	1.008
Unusable	1		1		3	
N. as Adj.	19	.925				
Abst. N.	10	1.345				
Gen. Av.	116	1.123				

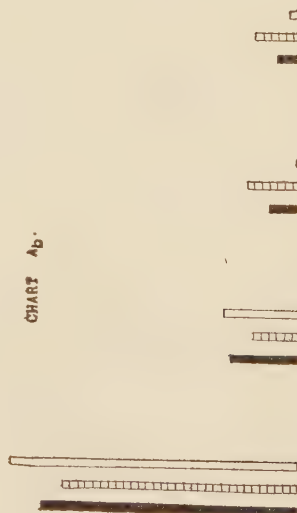
#31.	N.		V.		M.	
Nouns	16	.644	9	.755	38	.641
Pron.			17	.655		
Prop.	1	.678				
Adj.	1	.681	7	.655	5	.646
Verbs	1	.452	1	.477		
Prep.			1	.755		
Phrase			2	.643	2	.642
Comple'tns	1	.843	5	.722	2	.650
Total	20	.648	42	.682	47	.642
Unusable	3		8		5	
N. as Adj.	17	.604				
Abst. N.	10	.728				
Gen. Av.	109	.658				

#32.	N.		V.		M.	
Nouns	21	1.295	22	1.609	44	1.467
Pron.			7	1.095		
Prop.	3	1.838	1	2.262	1	1.196
Adj.	6	1.095	7	1.098	3	.834
Verbs	1	.677				
Prep.			7	1.031	1	1.460
Unclass.	1	.938				
Total	32	1.278	44	1.369	49	1.423
Unusable	1		6		1	
N. as Adj.	7	1.163				
Abst. N.	10	1.616				
Gen. Av.	125	1.367				

TABLE A_g.

Summarized results showing the relative length of the average reaction times to Modifier, Noun and Verb stimuli. Number of subjects 30.

	Shortest	Medium	Longest
Case	3	3	3
Modifier	20	7	23.3
Noun	9	13	43.3
Verb	1	10	33.3

CHART A_B.

Noun responses. Noun stimuli
 Modifier responses Modifier stimuli
 Verb responses Verb stimuli

This chart represents the proportion of Noun (including Noun, Pronoun and Proper Noun,) Verb, Modifier and All other Responses (including Prepositions, Exclamations, Interrogations, etcetera) responses to each of the three form of stimuli.

The figures represented in the chart are given below. Column #1 gives the total number of responses; #2 the Noun responses; #3 the Modifier responses; #4 the Verb responses; #5 all the other responses.

Noun stimuli	1	2	3	4	5
Percent of cases	100	68	18	8	6
Actual number	866	586	165	65	60
Verb stimuli					
Percent of cases	100	62	13	14	13
Actual number	1,399	874	164	197	164
Modifier stimuli					
Percent of cases	100	76	20	1	3
Actual number	1,443	1,090	282	16	45

TABLE A_C.

	Shortest react. time		Medium react. time		Longest react. time	
Noun Stim.	N	V	N	M	N	M
	4	16	10	11	7	15
Mod.	12	15	3	13	11	4
Verb	3	16	11	17	10	3
Totals	19	47	24	41	29	14
	21%	56%	27%	46%	32%	16%
					30	11(3)
					23%	15%
					23%	23%

This table shows the relative length of reaction times for the three different verbal forms of reaction, both as regards their total appearance for all the stimuli given, and as regards their appearance in connection with each of the three verbal forms of stimuli. The numbers in parentheses signify the number of cases in which the particular form in question did not appear as a reaction. Thus there were 6 out of the 80 subjects who did not use the verb reaction for any of the noun stimuli given.

TABLE B - 1.

	1	2	3	4	5	6	7
1. Use	27	89%	3.280				
2. Imitate	21	67	2.079				
3. Warn	27	74	2.107				
4. Admire	29	80	1.959				
5. Take	29	79	1.940				
6. Find	29	69	1.937	24	2.096	5	1.175
7. Conclude	25	84	1.933				
8. Abuse	25	80	1.870				
9. Suck	29	90	1.797				
10. Kill	29	76	1.775				
11. Threaten	28	75	1.755	23	1.929	5	.955
12. Protect	30	73	1.750	23	1.955	7	1.077
13. Expect	28	68	1.749	23	1.941	5	.867
14. Fail	26	65	1.719	20	1.753	6	1.673
15. Consider	28	54	1.674	23	1.511	5	2.422*
16. Advertise	29	69	1.651	24	1.547	5	2.145*
17. Possess	29	69	1.628	24	1.582	5	1.850*
18. Eat	24	75	1.625	19	1.842	5	.798
19. Read	25	50	1.590	18	1.645	8	1.466
20. Stumble	27	56	1.556	19	1.601	8	1.443
21. Rob	30	50	1.498	25	1.566	6	1.159
22. Despise	29	66	1.496				
23. Provide	30	47	1.492	19	1.736	11	1.071
24. Grow	29	66	1.490	24	1.463	5	1.617*
25. Run	28	66	1.479				
26. Conquer	29	72	1.459				
27. Accept	29	66	1.435				
28. Gather	29	76	1.412	24	1.482	5	1.078
29. Lend	28	52	1.408	8	1.643	6	1.491
30. Sew	30	60	1.372			14	1.237
31. Receive	30	60	1.365				
32. Feel	29	69	1.249	24	1.399	5	1.593*
33. Learn	29	62	1.314	21	1.323	8	1.291
34. Follow	27	48	1.308	13	1.495	14	1.135
35. Sand	26	61	1.273	23	1.330	5	1.010
36. Think	29	66	1.269				
37. Get	29	69	1.261	23	1.278	5	1.194
38. Recite	29	59	1.261+	16	1.261-	7	.939
39. Allow	30	40	1.231	14	1.646	16	1.639*
40. Borrow	27	41	1.224	10	1.261	5	.869
41. Believe	30	47	1.213	13	1.338	17	1.268*
42. Tell	29	48	1.210	17	1.192	7	1.117
43. Forgive	30	40	1.210	14	1.466	16	1.452*
44. Owe	27	48	1.206	14	1.242	7	.925
45. Arise	28	64	1.204	22	1.272	6	.987
46. Heap	29	51	1.187	10	1.405	14	1.373*
47. Come	29	48	1.140	24	1.183	5	.989
48. Listen	29	59	1.134	22	1.156	7	1.114
49. Bake	29	28	1.091	11	1.263	13	.958
50. Go	30	63	1.066				.932
							1.067
							.977
							.990

TABLES B - 1, B - 2, B - 3. In these tables the various columns appearing after the stimuli give the following facts regarding the reactions and reaction times for these stimuli: Column #1 gives the total number of reactions of all the subjects to each stimulus; #2 gives the percentage of different responses to each stimulus; #3 gives the average of the reaction times of all the subjects to the given stimulus; #4 gives the number of responses of which no one appeared as many as five times; #5 gives the number of same reactions to the given stimulus whenever five or more than five subjects have given the same response; #6 gives the average reaction time for the responses represented in column 4, while #7 gives the average reaction time for the responses represented in column 5; #8 (in Table B - 3) gives the number of times in which the stimulus was interpreted and used as an adjective; #9 gives the average reaction time for the responses represented in column 8.

The asterisk in column 7 is for the purpose of making it easy to see at a glance which of the average reaction times of those reactions appearing five or more times for a given stimulus are longer than the average of the reaction times of all the other reactions to that stimulus.

TABLE B - 2.

	1	2	3	4	5	6	7
1. Considerate	28	71	2.652	23	2.933	6	1.620
2. Tearful	30	63	1.839	23	2.067	7	1.037
3. Sincere	28	54	1.793	22	1.912	6	1.356
4. Tiresome	29	79	1.778				
5. Harmful	30	80	1.768				
6. Quick	29	79	1.741				
7. Costly	30	73	1.670				
8. Skilful	28	68	1.590				
9. Pleasing	29	83	1.587				
10. Mean	30	50	1.553	16	1.768	14	1.307
11. Alert	26	64	1.541				
12. Unkind	30	63	1.541	21	1.728	9	1.107
13. Marvelous	29	52	1.532	23	1.366	6	2.169*
14. Greasy	30	73	1.531				
15. Careful	27	81	1.440	22	1.409	5	1.573*
16. Sick	30	60	1.429	25	1.919	5	.985
17. Ragged	29	48	1.418	23	1.672	6	.822
18. Peculiar	28	50	1.415	18	1.659	10	.978
19. Boisterous	30	47	1.408	18	1.635	12	1.067
20. Proud	30	67	1.404	24	1.403	6	1.408*
21. Stupid	29	52	1.375	24	1.443	5	1.047
22. Gloomy	30	50	1.362	14	1.799	9	1.123
						7	1.114
23. Nice	26	46	1.332	19	1.329	7	1.303
24. Purple	30	57	1.320	24	1.388	6	1.048
25. Simple	29	55	1.305	15	1.430	9	1.176
						5	1.158
26. Handsome	30	30	1.284	14	1.537	16	1.064
27. Difficult	30	53	1.265	17	1.416	6	.938
						7	1.178
28. Dirty	30	77	1.217				
29. Damp	29	59	1.207	23	1.263	6	.993
30. Dry	30	73	1.201				
31. Bashful	30	40	1.199	15	1.302	15	1.097
32. Weary	30	47	1.196	13	1.548	11	.968
						6	.852
33. Sandy	30	47	1.147	17	1.293	13	.956
34. Yellow	28	64	1.139	20	1.205	8	.975
35. Dark	30	43	1.131	13	1.293	7	1.392*
						5	.666
36. Blue	30	60	1.126	24	1.095	6	1.247*
37. Red	28	79	1.116				
38. Funny	30	63	1.114	23	1.171	7	.928
39. Bright	30	33	1.107	14	1.240	16	.982
40. Muddy	30	30	1.103	8	1.489	7	1.204
						8	.736
						7	.982
41. Dusty	29	52	1.100	18	1.264	11	.830
42. Shady	30	47	1.063	14	1.022	7	1.167*
						9	1.012
43. Slippery	30	40	1.063	11	.943	9	1.389*
						10	.903
44. Ripe	29	34	1.046	12	1.186	5	1.101
						12	.882
45. Windy	30	20	1.040	6	1.317	25	.984
46. Green	30	53	1.015	23	1.067	7	.847
47. Feeble	28	25	1.015	12	.999	16	1.028*
48. Rich	29	28	1.000	6	1.122	15	.856
						8	1.181*
49. Poor	29	38	.996	7	1.209	5	1.146
						6	.835
						5	.845
50. Fresh	29	41	.961	17	1.028	12	.865

TABLE B - 3**

	1	2	3	4	5	6	7	8	9
1. Prison	5	100	2.082						
2. Heart	14	93	1.917					24	1.107
3. Farmer	23	63	1.843	18	2.050	5	1.097	14	1.293
4. Goat	29	76	1.817					7	1.197
5. Ear	24	50	1.679	19	1.752	5	1.400	5	1.408
6. Lawyer	28	79	1.620	22	1.640	6	1.546		
7. Policeman	29	69	1.604	24	1.689	5	1.193		
8. Star	25	56	1.590					4	.872
9. Sky	6	25	1.520					22	.957
10. Baby	12	75	1.516					18	1.096
11. Preacher	29	68	1.496						
12. Needle	27	33	1.496	12	1.765	15	1.278	2	.973
13. Cow	27	48	1.488	17	1.517	12	1.200		
14. Angel	16	81	1.463					14	.987
15. Teeth	29	62	1.453						
16. Onion	23	65	1.443					5	1.031
17. Snake	16	56	1.430					14	.995
18. Apple	7	71	1.415					23	.928
19. Month	28	54	1.375	23	1.387	5	1.330		
20. Mattress	26	31	1.362	12	1.553	14	1.199		
21. Physician	29	48	1.360	15	1.427	9	1.286		
						5	1.294		
22. Stork	28	39	1.344	13	1.509	16	1.201		
23. Chocolate	4	100	1.340					26	.968
24. Hell	29	45	1.334	17	1.492	13	1.111		
25. Negro	23	52	1.313	12	1.633	11	.965	6	.970
26. Hat	27	56	1.276	17	1.440	10	.996	3	1.257
27. Ladder	30	53	1.269	16	1.439	6	1.109		
						8	1.048		
28. Door	14	57	1.254	8	1.292	6	1.204	15	1.005
29. God	28	75	1.247						
30. Lion	30	50	1.187	16	1.376	7	1.018		
						7	.924		
31. Straw	7	43	1.147	2	1.363	5	1.061	22	1.144
32. Cigar	7	71	1.122					23	1.125*
33. Brick	15	53	1.095	10	1.212	5	1.040	13	1.084
34. Cup	26	42	1.092	13	1.170	5	1.109	2	.675
						8	.954		
35. Husband	30	10	.961	2	.969	28	.913		
1. Hesitation	29	86	2.374						
2. Excitement	27	89	2.104						
3. Activity	28	86	2.072						
4. Knowledge	30	50	2.032	24	2.047	6	1.970		
5. Sympathy	30	83	1.928						
6. Decision	30	80	1.858	25	1.931	5	1.496		
7. Wisdom	30	70	1.652						
8. Purpose	29	85	1.582						
9. Approval	28	86	1.540						
10. Ability	30	67	1.375	20	1.462	5	1.114		
						5	1.286		

** In this tabulation of the noun stimuli the abstract nouns have been put in a separate group at the end. Of the forty concrete nouns, five have been omitted because there was grave doubt as to the proportion of times in which they were used by the subjects as nouns and as adjectives. For further explanation of this table see note on Table B - 1.

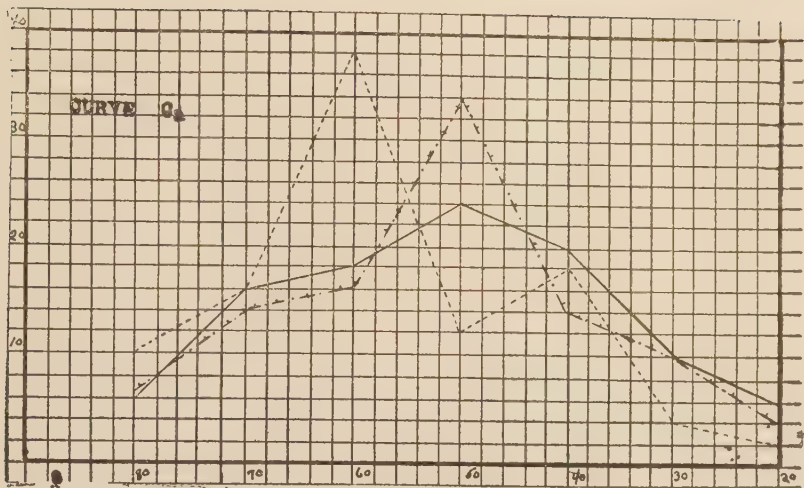
TABLE C.*

VERBS			MODIFIERS			NOUNS		
Gen. Aver. of 50		1.536	Gen. Aver. of 50		1.352	Gen. Aver. of 29		1.426
1. Suck	90%	1.797	1. Pleasing	83%	1.587	1. Heart	93%	1.917
2. Use	89	3.280	2. Careful	81	1.440	2. Angel	81	1.463
3. Conclude	84	1.933	3. Harmful	80	1.768	7% Average		1.690
4. Admire	80	1.953	6% Average		1.598			
5. Abuse	80	1.870						
10% Average		2.168						
1. Take	79	1.940	1. Tiresome	79	1.778	1. Lawyer	79	1.630
2. Kill	76	1.775	2. Quick	79	1.741	2. Goat	76	1.817
3. Gather	76	1.412	3. Red	79	1.116	3. Baby	76	1.516
4. Threaten	75	1.755	4. Dirty	77	1.217	4. God	75	1.247
5. Eat	75	1.685	5. Costly	73	1.670	14% Average		1.550
6. Warn	74	2.017	6. Greasy	73	1.551			
7. Protect	73	1.750	7. Dry	73	1.201			
8. Conquer	72	1.495	8. Consider	71	2.933			
16% Average		1.718	16% Average		1.648			
1. Find	69	1.937	1. Skilful	68	1.690	1. Policeman	69	1.604
2. Advertise	69	1.651	2. Proud	67	1.404	2. Preacher	68	1.496
3. Possess	69	1.582	3. Alert	64	1.541	3. Onion	65	1.443
4. Feel	69	1.349	4. Yellow	64	1.139	4. Farmer	63	1.843
5. Get	69	1.261	5. Tearful	63	1.839	5. Teeth	62	1.453
6. Expect	68	1.749	6. Unkind	63	1.541	17% Average		1.568
7. Imitate	67	2.079	7. Funny	63	1.114			
8. Despise	66	1.496	8. Sick	60	1.429			
9. Grow	66	1.490	9. Blue	60	1.126			
10. Run	66	1.479	18% Average		1.414			
11. Accept	66	1.435						
12. Think	66	1.269	1. Damp	59	1.207	1. Door	57	1.254
13. Fail	65	1.719	2. Purple	57	1.320	2. Star	56	1.590
14. Arise	64	1.204	3. Simple	55	1.305	3. Snake	56	1.430
15. Go	62	1.066	4. Sincere	54	1.793	4. Hat	56	1.267
16. Learn	62	1.314	5. Difficult	53	1.265	5. Month	54	1.375
17. Send	61	1.273	6. Green	53	1.015	6. Ladder	53	1.269
18. Sew	60	1.372	7. Marvelous	52	1.532	7. Brick	53	1.095
19. Receive	60	1.355	8. Stupid	52	1.375	8. Negro	52	1.313
38% Average		1.426	9. Dusty	52	1.100	9. Ear	50	1.679
1. Recite	59	1.261	10. Mean	50	1.553	10. Lion	50	1.187
2. Listen	59	1.134	11. Peculiar	50	1.415	54% Average		1.348
3. Stumble	56	1.556	12. Gloomy	50	1.352			
4. Consider	54	1.675	24% Average		1.354			
5. Read	50	1.590	1. Ragged	48	1.573	1. Cow	48	1.488
6. Rob	50	1.498	2. Boisterous	47	1.408	2. Physician	48	1.360
12% Average		1.452	3. Weary	47	1.196	3. Hell	45	1.354
			4. Sandy	47	1.147	4. Cup	42	1.092
			5. Shady	47	1.063	14% Average		1.319
			6. Nice	45	1.353			
1. Follow	48	1.308	7. Dark	45	1.151			
2. Tell	48	1.210	8. Fresh	41	.981			
3. Owe	48	1.206	9. Bashful	40	1.199			
4. Come	48	1.140	10. Slippery	40	1.063			
5. Provide	47	1.490	20% Average		1.207			
6. Believe	47	1.213						
7. Borrow	41	1.224	1. Poor	38	.996	1. Stork	39	1.344
8. Allow	40	1.231	2. Ripe	34	1.046	2. Needle	33	1.456
9. Forgive	40	1.210	3. Bright	33	1.107	3. Mattress	31	1.362
18% Average		1.248	4. Handsome	30	1.284	4. Husband	10	.969
			5. Muddy	30	1.103	14% Average		1.293
1. Lend	32	1.408	6. Rich	28	1.000			
2. Repay	31	1.187	7. Feeble	25	1.015			
3. Bake	28	1.091	8. Windy	20	1.040			
6% Average		1.229	16% Average		1.074			

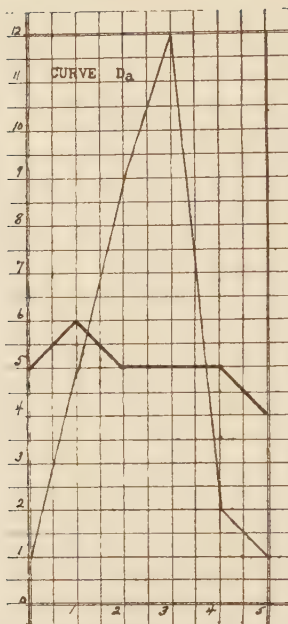
*In the tabulation of the nouns in this table numbers 1, 9, 18, 23, 31, and 32 found in Table B - 3 were not used. The number of times that the stimulus was interpreted as a noun in each of these cases - ranging only from four to seven - was so small that the averages obtained from them could hardly be considered as fair average noun reactions.

In this table we have each of the three verbal forms of stimuli arranged in separate groups. The different stimuli of each of these groups are arranged in the order of their percentage of distribution of responses. This percentage is shown in the first column after the stimulus words. In the second column is given the average of all the reaction times to each particular word. This table also shows the percentage of each group of stimuli falling within each 10% range of percentage of distribution (with the exception of the upper range which is taken as between 80% and 100%, and the lower range, which is taken as between 10% and 40 %.) Together with each range is given the average of all reaction times falling within that range for each group of stimuli.

CURVE C_a.



Curve C_a shows the percentages of distribution of responses for the three different forms of verbal stimuli; Verbs-----, Modifiers-----, and Nouns-----. On the ordinate are shown the percentages of the various forms of stimuli having percentages of distribution corresponding to the numbers shown on the abscissa. For example, there are 10% of all the verb stimuli that have percentages of distribution ranging from 80 to 100.

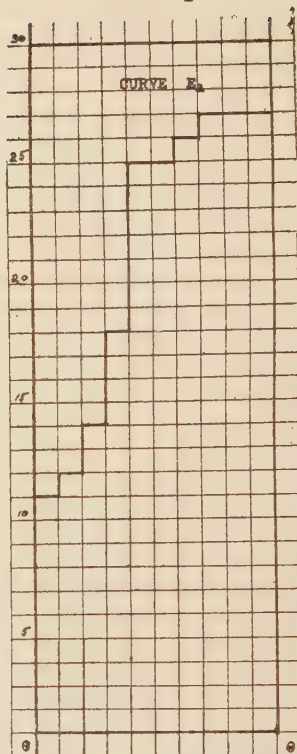
CURVE D_a

Curve D_a shows the influence of direct (light line) and indirect (heavy line) order of pairs, 5 each, over the 30 cases. The ordinate represents the number of cases, the abscissa the number of successful influences.

TABLE E_c.

Stimuli.	Responses.
Pork and	Meat, Pork -chop, Sausage.
Bread and	Butter(13), Water (4), Knife.
Horse and	Carriage, Cat, Cow, Waggon, Wheel.
Crackers and	Soup, Butter, Jam, Milk.
Ham and	Bacon, Beans, Cheese.
Liver and	Onions, Meat, Eggs (3), Heart, Lungs, Gravy, Cheese, Lead, No Reply, Ham.
Sing and	Hall, Sing in Bliss, Sing Sing, Play Music.
Coffee and	Tea(6), Milk (3), Buns(5), Muffins, Bread, Wafers, Doughnuts, Cake, Sugar, Butter.
Ice-cream and	Candy, Soda, Pie.
Biscuit and	Bread(8), Doughnuts (2), Honey (2) Eggs (2), Coffee, Milk.

The above table shows the distribution of the unsuccessful responses to the and form of influence. In cases in which the unsuccessful response was given more than once, the number of times that it appeared is given in parentheses.

CURVE E_a.

In Curve E_a the units along the abscissa represent pairs of and form stimuli. The units on the ordinate represent the number of successes out of a possible 30. The varying degree of success of the various pairs is thus shown.

TABLE F_a.

Interpreted as Noun*

	A	B		A'	B'
Watch	71%	74%	Pick	35%	43%
Jar	100	91	Boil	22	43
Match	71	87	Sign	100	57
Pound	83 ^a	75 ^b	Fit	57	43
Train	71	95 ^c	Stand	39	57

Stimuli used adjectively considered the same as those used substantively.

a 6 cases only. b 20 cases only
c 22 cases only

A = preceded by noun form 7 cases
B = preceded by noun form 23 cases
A' = preceded by verb form 23 cases
B' = preceded by verb form 7 cases

The average % for A and A' 57%
The average % for B and B' 76%

TABLE D - 1.										TABLE D - 2.									
Stimuli:	Subjects 1	2	3	4	5	7	8	% of successes	Av. reac. of successes	Stimuli:	Subjects- 9	10	11	12	13	14	15		
Lunch Counter	1.134		.654				1.125	43	.971	Counter Lunch									
Sweeper Carpet			1.386	1.880		1.706	1.729	57	1.675	Carpet Sweeper			1.368	1.966		1.366			
Chimney Sweep			.769	1.053			1.251	43	1.024	Sweep Chimney				.973		3.987*			
Store Drug			.710	.821	.629	.900	.826	71	.777	Drug Store	1.341	2.235		1.201	.995	.948			
Salt Pork								0		Pork Salt				1.470		1.257			
Box Music				.895	.879		.924	43	.899	Music Box						1.181			
Suit Case					.960	.789		29	.875	Case Suit				.639		.956			
Cushion Pin			.685	.681	.683		.777	57	.682	Pin Cushion	1.272			1.954	.898	1.101			
Coal Bin	1.798			1.009	.768	.840	.821	71	1.049	Bin Coal	1.739				.717	.965	.890		
Syrup Maple			.838	.453	.672	1.157	.898	71	.800	Maple Syrup	1.334	1.169	1.118	1.032	.802	1.624	1.457		
Av. React. of Dir.Suc.	1.134	1.798	.712	1.051	.864	.814	1.069			Av. React. of Dir.Suc.	1.318	2.202	1.243	1.538	.898	1.244	1.457		
of Ind.Suc.			.880	.942	1.216	1.254	.831			of Ind.Suc.	1.739			1.027	.717	1.791	.890		
Gen. Av. (From Table A.)	1.157	1.969	1.479	1.117	.881	1.497	1.194			Gen. Av. (From Table A.)	2.347	2.094	2.591	1.494	1.261	3.047	1.654		
										*Couldn't think of anything. Answer finally suggested by the pr									

*Couldn't think of anything. Answer finally suggested by the pro

TABLE E.																		
Subjects - 1	2	3	4	5	6	7	8	9	10 ^b	11	12	13	14	15	16	17	19	20
Stimuli:																		
Beans					Meat				P. Chop									
Pork and	1.049	1.909	.484	1.233	.474*	1.042	2.299 ^a	1.675	2.854*	1.540	.794	1.234	1.236	1.182	.973	1.880	1.324	1.869
Milk	Butter	Water		Water		Butter	Butter	Butter	Butte		Butter		Butter	Butter		Water	Knife	
Bread and	.782*	1.460*	1.072	.834*	.898	1.112*	1.102*	.964*	1.917*	1.152	.963*	1.050	1.046*	1.069*	.897	1.183*	1.371*	.739
Buggy		Carriage							Cat									
Horse and	.802	1.569*	.900	.855	.693	.889	1.006	1.307	2.326*	1.244	.967	.903	.884	1.123	.711	.993	.699	1.000
Cheese									Soup									
Crackers and	.739	1.926	.710	.746	.814	.889	.861	1.721	3.640*	1.726	.718	1.132	1.266	1.049	.725	.960	Jam	
Eggs									Bacon								Cheese	
Ham and	.842	1.118	1.034	.738	.720	2.825	.925	.969	1.224*	1.299	.709	.713	.655	.961	.709	1.124	1.063*	.869
Bacon			Onions	Meat	Eggs						Heart	Lungs		Gravy			Cheese	Egg
Liver and	1.587	1.447	1.840*	.913*	.864*	.749	1.061	2.711	1.057	1.176	2.080*	3.049*	.894	5.579*	1.480	1.570	1.354*	2.669
Dance					Hall			^c								^f		
Sing and	.573	2.929	1.651	.942	.904*	.898	.871	3.009*	.563	1.984	.726	1.170	2.485	1.393	.794	5.872*	.949	1.100
Rolls					Buns	Tea			Milk			Tea		Milk		Wafers	Tea	Sug
Coffee and	.622	1.756	1.024	.944	.875	.893*	.763*	1.645	2.784*	1.134	.836	.889*	.960	.892*	.703	3.764*	1.257*	1.300
Cake				Pie										Soda				
Ice-cream &	.728*	1.256	1.050	.820*	.895	.721	.985	.762	2.234	1.923	.786	1.106	1.071	.929*	.827	1.174	.741	.739
Butter		Milk	d	Eggs		d	Bread		Coffee			Bread	Bread		Bread	Honey		
Biscuit &	1.066	3.341*	1.237*	1.082*	.872	1.752*	.772*	1.195	2.399*	1.104	2.041	.846*	2.535*	1.290	1.011*	2.200*	.976	1.869
Av. Suc.	.915	1.763	.991	.893	.824	1.145	1.144	1.498	1.285	1.428	.947	1.044	1.181	1.166	.869	1.284	.938	.900
Av. Unsuc.	.755	2.123	1.539	.915	.711	1.252	.879	1.927	2.449		1.522	1.261	1.791	2.117	1.011	3.255	1.309	2.000
Av. Both	.833	1.871	1.100	.901	.790	1.177	1.065	1.600	2.100	1.428	1.062	1.109	1.303	1.547	.883	2.072	1.123	1.200
Gen. Av. ^c	1.157	1.969	1.479	1.117	.881	1.497	1.194	2.347	2.094	2.591	1.494	1.261	3.047	1.654	1.124	2.406	1.094	1.200

a "Couldn't read test word at first." b Note that #10 a student from China has the least number of successes of any subject, while #26, a Chin
d Doughnut. e From Table A 1-32. f Sing Sing. g Time lost by apparatus not working. h No reply given. i The aver
influence was not successful. The words above these cases are the responses in these cases.

16	17	19.	20	21	22	23	24	25	26	27	28	29	30	31	32
		.850		.806						1.540				.323	17 .882
.836	1.206	.945		1.229			1.258	1.232	1.339	1.144				.951	52 1.237,
.084	1.139	.982		.818	.906	.811	.900	.682		.971		1.014	.717	.491	1.177 68 1.083
1.022			1.362	.817	.978				1.327	.839	.424			.917	1.250 61 1.118
		.654		.824		1.089				.749	.410			.763	35 .902
	1.134														9 1.157
1.153				.764			.586		.919	.684				1.257	35 .895
	1.582	1.265		.559	1.034			.638	1.335		1.007			1.185	52 1.153
	1.243	.724		.801		.913	.736	.533	2.046	.913		.668	.545	.270	65 .915
1.523	1.484	1.070	.952		1.181			.432		1.164	1.164	1.216	1.016	.602	1.201 83 1.134
1.127	1.350	1.093	1.157	.868	1.064		1.258	.767	1.334	1.049	.865	1.216	1.101	.760	1.134
.918	1.191	.805		.803	.906	.938	.741	.608	1.483	.722	.722	.410	.821	.821	.361
1.124	2.406	1.094	1.490	.971	1.189	1.080	.889	.769	1.978	1.023	.797	1.280	1.123	.658	1.367

ous work."

21	22	23	24	25	26	27	28	29	30	31	32	A	B	C	D
1.172	1.041	Sausage .887*	.933	.787	1.378	.897	.575	.970	.826	.690	1.282	90	1.169	1.738	-.579
.830	Water .833*	1.063	Butter .886*	Butter .759*	Butter 1.086*	.745	.429	Butter .902*	.950	Butter .321*	1.367	40	.936	1.033	-.097
.788	.818	Cow 1.042*	.699	.598	1.054	.723	.533	.678	Waggon .684*	Wheel .642*	1.093	83	.872	1.249	-.377
.875	.725	.616	.726	Butter 1.560*	.909	.373	.693	Milk .988*	.686	.740	87	.921	1.922	-1.001	
.617	.900	Beans .651*	.672	.665	.847	1.059	1.156	.869	.679	.614	.623	90	.922	.979	-.057
Lead .948*	.998	h 1.066*	Ham .984*	.498	1.254	.732	.634	Eggs 3.810*	.629	.706	1.500	60	1.149	1.996	-.847
.964	Play .920*	.831	.832	.792	Music 1.699*	.923	.473	.762	.689	.666	1.055	83	1.081	2.431	-1.400
Bread .863*	1.015	Tea .742*	Buns .756*	Butter .598*	Tea 1.828*	Tea .989*	Muffins 1.860*	Buns .646*	Milk 1.407*	d .432*	Cake 1.183*	37	1.047	1.259	-.313
1.908	.922	.823	.901	.599	1.085	.836	1.053	1.180	.799	.771	1.079	90	1.494	.826	+668
.971	1.196	Bread .837*	.913	.512	Bread 1.886*	Bread .769*	.758	.820	Eggs .886*	Bread .618*	Honey 1.407*	47	1.108	1.474	-.566
1.036	.971	.861	.795	.647	1.124	.853	.643	.853	.762	.689	1.092				-.4381
.906	.876	1.038	.875	.679	1.612	.879	1.860	1.785	.986	.503	1.295				
1.007	.952	.967	.819	.653	1.358	.658	.764	1.132	.852	.615	1.133				
.971	1.189	1.080	.889	.769	1.978	1.023	.797	1.280	1.183	.668	1.367				

student who has lived in this country practically all his life.
 saving for each of the ten pairs. * The cases in which the

c Sing in Bliss.

A = % of successful influences
 B = Av. Reaction time of these
 successful influences.
 C = Av. Reaction time of the
 unsuccessful influences
 D = Difference between B and C

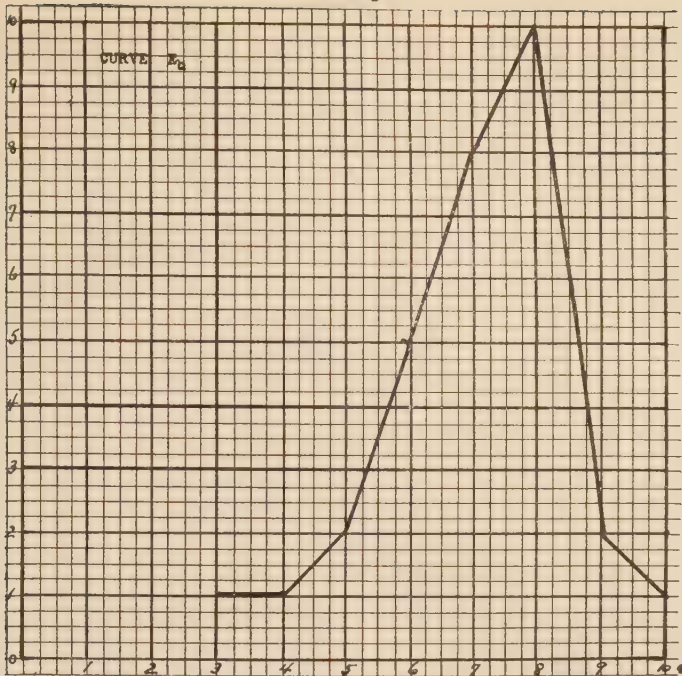
CURVE E_b.

TABLE F - 1.

Preceded by Noun Form								Preceded by Verb Form							
	1	2	3	4	6	7	8		1	2	3	4	6	7	8
Watch	N	N	N	N	N	N	N	Pick	V	V	V	V			
Jar	N	N	N	N	N	N	N	Boil	V	V	V	V			
Watch		N	N	N	N	N	N	Sign	V		V			V	
Pound	O	N	N	N	N	N	N	Fit	V		V	V			
Train	N	N	N	N	N	N	N	Stand	V	V	V			V	

TABLE F - 2.

Preceded by Verb Form																															
	9	10	11	12	13	14	15	16	17	19	20	21	22	23	24	25	26	27	28	29	30	31	32								
Watch								V			V			V									V	V							
Jar																															
Watch																V															
Pound											V				V	O					V	V	V	V							
Train																O															

Preceded by Noun Form																															
	9	10	11	12	13	14	15	16	17	19	20	21	22	23	24	25	26	27	28	29	30	31	32								
Pick	N	N	N	N	N						N						N														
Boil		N			N													N													
Sign	N	N	N	N	N	A	A	A	A	N	N	A	A	A	A	A	A	A	N	A	A	A	A								
Fit	N		N	N	N		N		N	N	N	N	N		N		N	N		N											
Stand	N		N	N	N	N		N				N		N			N														

Tables F - 1 and F - 2. In these two tables are given the results with the ten ambiguous verbal forms appearing under the two different conditions - preceded by ten definite verb forms, preceded by ten definite noun forms. At the head of each column of results is given the number of the subject whose reaction are therein presented. The letters in the columns signify the interpretation given the ambiguous stimulus word: V, verb; N, noun; A, adjective; O, ambiguous. The ambiguous reactions are omitted from the calculations made in the text. When no letter appears in the column it means that the interpretation of the ambiguous form is of a character opposite to that of the ten preceding definite forms.

TABLE G.

Subjects - 1	2 ^b	4	6	7	8	9	10	11	12	13	14	15	16	
Stimuli:														
Nationality	Jew 1.677	Jewish 2.539	Is'elite .750	Jews 1.807		Swede ^a 2.764	Jew 2.055	German* 2.064	Jew 1.319	Jew 1.766	Jew 1.641	It'ns* 3.410	Clerks* 1.355	Jew 1.395
Tom	Cabin .833	U. Tom 2.119	Brown .492	U. Tom 1.023	Uncle 1.146		U.T.C. ^c .705	U.Tom 1.533	UTC ^c - - -	UTC ^c 1.379	Cabin .776	UTC ^c .865	Uncle 1.279	Whips 1.115
Organ	Grinder 1.474	Grinder 1.051	Monkey 1.455	Monkey 1.227	Dago 1.179	Monkey 1.588	H.Organ 1.032	Play ^d 4.371	O.Gr'r .705		Grinder 1.027	OGJ 1.886	Pipe* 1.260	Junk S* .809
Brush				Sage 1.420	Cactus .690	Sage 1.509	Wood* .909	Brush 1.570	e* 7.390	Brush 1.013	Sage 1.743			Sand* .885
Shrill ^f														
Av. Suc.	1.328	1.903	.899	1.369	1.005	1.954	1.264	2.491	1.012	1.586	1.297	1.376	1.279	1.255
Av. Unsuc.							.909	2.064	7.390			3.410	1.308	.847
Gen. Av. ^g	1.157	1.969	1.117	.881	1.497	1.194	2.347	2.094	2.591	1.494	1.261	3.047	1.654	1.124

Table G gives the results of the tests for the influence of a given preceding condition. Just before each stimulus the subject was told to be thinking of a given situation. These situations were: for Nationality - A burning clothing store; for Tom - Slavery times down South just before the Civil War; for Organ - An Italian quarter in a large city; for Brush - The Great American Desert; for Shrill - The manufacturing district of a large city, just at the noon hour. In the columns for the different subjects appear the reactions to the various stimuli. Immediately under each such reaction appears its reaction time. Blanks in the columns are caused by omission of the stimuli, failure of response, misunderstanding of instructions, etcetera.

* Considered as cases of unsuccessful influence.

- a "Last big fire that I remember was in burned. When I saw Nationality I thought connected up with Swede."
b Number three was not tested with these
c Uncle Toms Cabin.
d "Saw man and woman playing hand organ couldn't think what called man that time."
e White-wash brush.
f Not given to any of the subjects until
g From Table A 1-32.
h Tomikins
i "Thought of time that Uncle Tom was so
k "Had picture of sage brush after the
j Organ Grinder.

17	19	20	21	22	23	24	25	26	27	28	29	30	31	32
11*	Jew	Sheeny	Jew	German*	Jew	Jew	Fire*	Jew	German*	Jew	Irish*	Fire'p*	Jew	Jewish
511	1.491	1.075	1.087	5.029	.346	.891	.385	1.319	.910	.591	1.516	1.453	.639	3.365
h*	Uncle.	Auct.	Uncle	W.Post	Harry*	Thumb*	Jerry*	Whip'g.	McQuir*	Uncle	Uncle	Black'n*	c *	Cabin
855	- - -	.766	.832	1.000	.934	1.451	.755	1.204	1.370	.730	1.640	1.578	.797	1.144
Grinder	F.Stand	Monkey	H.Organ	Grinder	Grinder	RisP	Monkey	Ch'l'n'	Chianti*	Grinder	Grind	Grinder	Grinder	Grinder
519	1.168	1.467	.791	1.195	.834	1.107	.370	1.194	1.743	.585	1.118	1.054	.736	2.559
sh*	Henk	Bones ¹	Sage	M.	Wood*	Fence*	Fire*	Cactus	Dry ^f	s*	t	Empty*	Wood*	Dust*
447	1.118	2.721	.698	3.770	.989	.974	.808	.726	.821	.604		1.430	.741	2.014
		Men*	Whistle	Whistle	Whistle			Whistle	Whistle	Whistle	Whistle	Loud*	Cry*	Whistle
		.600	1.961	1.343 _u				1.943	2.241	- - -	1.088	2.166	1.176	2.111
	1.259	1.521	.852	1.982	.841	.999	.270	1.277	1.602	.661	1.282	1.054	.683	2.270
228		1.467	.600	5.029	.962	1.213	.649		1.090	.595	1.516	1.654	.905	2.111
406	1.094	1.490	.971	1.189	1.080	.889	.769	1.978	1.023	.797	1.280	1.123	.658	1.567

aha. Was a white headed fireman
 ht of that and finally white headed
 stimuli

the street. Reason for long time,
 ned the crank."

#21.

down South." [of brush hen.
 rd was given and that made me think

l "Saw sage brush and bleaching bones on the sand. Hadn't had any bones in my
 picture until the word brush was seen. Had to change my picture when the
 word brush came, because didn't have it in the picture. Was twenty mule
 borax team."

m Camel's tail. n "Black Tom, not Uncle Tom. o The Boot Black.
 p Jacob Riis. q "Thought of a lot of children around an organ grinder."
 r "Thought of bush out there. Barreh. Dry could express the appearance of it"
 s Salamander

t By mistake this stimulus was given with the same situation as was usually
 given for the stimulus organ. The response was shoe. The introspection -
 "When the condition was given saw a street and Italians. After the test
 word came, also saw little Italian shoe-boy brushing shoe." This is inter-
 esting as showing how the same situation influenced two separate reactions
 for the same individual.

u "Couldn't make out the test word at first."

